CHEMISTRY

VEMBER
961

rty-fifth
Year

NEW WEAPON AGAINST INSECTS

PUBLIC SERVICE
ELECTRIC AND GAS COMPANY
LIBRARY, P. S. TERMINAL
NOV 29 196
80 PARK PLACE, ROOM 8236
NEWARK, NEW JERSEY

	Page
Chemosterilants	1
Nobel Prize Winners	4
Chemistry Quiz	8
On the Back Cover	8
Foams Are Big Business	9
New Radiation Study Approach	21
Serum Amino Acids: STS Project Report	31
Radiation Preserves Foods	36
For the Home Lab: Algol Yellow R	37
Two-Dial Torsion Balance	39
New Chemical Patents	41
Origin of Volcanoes	43
Proudly Presented	46
Book Condensations	48
Chemistry Comments	Inside Back Cover

Editorial:
New Aids to Teaching Chemistry
Inside Front Cover

50¢

A SCIENCE SERVICE PUBLICATION

New Aids to Teaching Chemistry

➤ THE MANY DEVELOPMENTS in the revision of chemistry courses for high schools and in various programs for assisting both the teachers and the students make this an exciting time for both student and teacher. The importance of chemistry to our society is receiving wide recognition.

This magazine has carried numerous reports of the activity of the Chemical Bond Approach Study and the Chemical Education Materials Study. Both of these groups are making valuable contributions to the teaching of chemistry in the secondary school. They have produced important additions to the literature for classroom use as well as for school laboratory use.

The Manufacturing Chemists' Association has conducted a program for assisting the teaching of chemistry for the last five years. Spurred on by the growing need for chemists in research and development, the chemical industry plans to continue this program at an increased tempo. One area of assistance by this group is directed at the junior high schools. A second area is directed towards college teaching. This consists in the selection of outstanding teachers for recognition. A third area is directed towards senior high schools and consists in the development of special experiments designed to create problem solving situations. The fourth area involves the production of teaching films. The fifth area is devoted to aid to elementary schools.

CHEMISTRY

Vol. 35, No. 3 Formerly Chemistry Leaflet November, 196
Including The Science Leaflet

Published monthly, September through April, by Science Service, Inc., the non-profit institution for the popularization of science. Publication Office: 326 W. Beaver Ave., State College Pa. Second class postage paid at State College, Pa., and at additional mailing offices. Address subscription and editorial communications to the Editorial Office: 1719 N Street N.W. Washington 6, D. C.

$4 a Year; Two-Year Subscriptions $7; Your Own and a Gift Subscription $7 a Year. 50¢ a Copy. Ten or more subscriptions to the same address: $2.90 a Year each. No charge for Foreign or Canadian Postage.

Editor: WATSON DAVIS

Consulting Editor: PAULINE BEERY MACK (Editor 1927-1944)

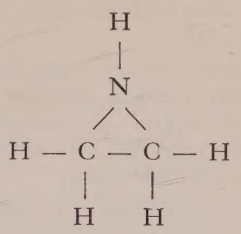
Editor in Memoriam: HELEN MILES DAVIS (1944-1957)

Copyright © 1961 by Science Service, Inc. All rights reserved. Science Service issues press service for newspapers and magazines, publishes Science News Letter (weekly), issues THINGS of Science (monthly) and administers Science Clubs of America.

Science Service is the educational and scientific institution, organized in 1921 as a non-profit corporation with trustees nominated by the National Academy of Sciences, the National Research Council, the American Association for the Advancement of Science, the Scripps Estate and the Journalistic Profession.

Chemosterilants

ew Researches on Chemicals romise Extraordinary Control ver Insects by Stopping Their exual Reproduction. Ethyleni- ine Family of Chemicals (For- ula at Right) Gives Most Prom- ing Derivatives.



CHEMICALS are being used successlly to stop the reproduction and us limit dangerous, destructive, dise-bearing insects, the U. S. Dertment of Agriculture has reported.

Derivatives of ethylenimine, a famy of chemicals used in cancer-therapy search, have effectively sterilized ints, completely halting reproduction test colonies of houseflies, mosquies, stable flies, screwworms, boll eevils and Mexican fruit flies.

The chemical causes sterility in ouseflies, for instance, when they eat or even when they walk over a eated surface. The flies live but their gs do not hatch.

Chemosterilants for insect control ve been under study for less than e years, but the sterility technique get rid of such pests is not new. sects have been sterilized in USDA periments by exposure to radioace cobalt-60 to control the screwrm in the Southwest. Because of e nature of the sterilant, the insects d to be treated in the laboratory and en released.

The radiation also affected sexual vigor. Studies show that male flies and mosquitoes sterilized with chemicals retain full sexual vigor and competitiveness.

A chemosterilant, nontoxic to warm-blooded animals, could be used in the field to sterilize native insect populations. It could be combined with an insecticide. The latter would reduce the population and the chemosterilant would destroy the reproductive ability of resistant survivors.

The effectiveness and promise of chemosterilants has been amply demonstrated. Now research will be aimed at finding how, when and where to apply chemosterilants to specific insects without creating hazards to humans, animals, crops or wildlife.

Finding the right compound can mean an annual saving of billions of dollars in the U. S. This is what the 93,000 different kinds of crawling or flying insect pests in the U. S. cause in agricultural losses.

Details of Chemosterilants

Agricultural Research (Nov.) issued by the U. S. Department of Agriculture, described the new research results as follows:

The possibility of using chemicals to sexually sterilize insects — as a means of control or eradication by preventing reproduction — is no longer just a scientific theory.

By treating laboratory-reared insects with minute quantities of sterilizing chemicals (chemosterilants) USDA scientists have completely halted reproduction in test colonies of several species — houseflies, mosquitoes, stable flies, screwworms, boll weevils, and Mexican fruit flies. Sterilized females laid no eggs, and the eggs laid by fertile females that mated with sterile males did not hatch. Sexual vigor and mating behavior were not affected.

In a preliminary field test, ARS entomologists of Orlando, Fla., almost eliminated a population of houseflies infesting a partially isolated refuse dump on a small uninhabited island. After 5 weekly applications of a bait containing a chemosterilant only a few flies could be found, and 99 percent of those captured were sterile.

As expected, the island was repopulated by houseflies from nearby islands and the mainland. Tests on a completely isolated island will be required to determine if eradication of houseflies can be achieved with chemosterilants.

The potential advantages of inducing sterility to control insects were first suggested by E. F. Knipling, head of USDA entomology research. This principle of insect self-annihilation i being intensively explored in ARS lab oratories at Orlando; Kerrville, Tex Honolulu, Hawaii; and Mexico City Mexico. Preliminary studies are als underway at other ARS laboratorie The scientists believe successful ap plication of this principle could hel us get rid of many destructive an dangerous insect pests.

The sterility technique was success fully used in 1958-59 to eradicate th screwworm from the Southeast. I that program, laboratory-reared screw worm flies were sexually sterilized b exposure to radioactive cobalt 60 an released weekly in sufficient number to reduce and finally wipe out th native screwworm population.

Advantages Offered By Chemicals

Chemosterilants have been studie for less than 5 years, but early result indicate they have advantages ove the use of radiation:

Studies at Orlando show that mal flies and mosquitoes sterilized b chemicals apparently retain full sexua vigor and competitiveness. In contras all species experimentally exposed t radiation have shown some degree c injury. Knipling estimates, for exam ple, that sexual vigor of irradiate screwworm flies was reduced abou 50 percent. This required doublin the number of sterile males release to provide the desired degree of com petition with normal males in th native population. An effective chemo sterilant that would not injure screw worm flies could have saved this extr cost and effort.

A safe chemosterilant could be used the field to sterilize native insect ›pulations. Sterile females would be capable of producing progeny, and ›rile males would compete with fer-e males in mating with any females at escaped the sterilizing treatment. his double effect would result in pid reduction of the insect popula-›n.

Using a chemosterilant against a *rge* insect population in a natural vironment would be cheaper and ore practical than rearing, steriliz-g, and releasing males. Also, any mporary hazard created by releasing ldditional insects would be avoided. the infestation is *small,* however, e release of sterilized males would robably be more economical and ractical. But even in laboratory steri-zation, chemosterilants might be pre-rred to radiation not only because emically sterilized males appear to stronger and more competitive but so because, in some cases, costs ight be lower.

Some 60 to 70 of the approximately 000 chemicals screened show some gree of sterilizing activity. Most omising are half a dozen derivatives ethylenimine, a family of chemicals ed in cancer-therapy research. These emosterilants are considered toxic warm-blooded animals and could ly be used under carefully con-›lled conditions.

They could be used safely, for ex-mple, to sterilize artificially reared sects, as irradiation was used in the rewworm program.

They might be safely added to a werful attractant, even though too zardous for field use as conventional sprays or dusts. Attractants are now in use or being tested on the gypsy moth, tobacco hornworm, European chafer, and fruit flies. Intensified research is underway to find attractants for other insects.

Screening Is Expected to Increase

Screening of chemicals is expected to increase to several thousand a year, and evaluation techniques are being further refined. The scientists are optimistic, therefore, that the compounds they're working with are forerunners of chemosterilants that will be safe, even if applied as insecticides are now.

In fact, a combination insecticide-chemosterilant is visualized as one answer to the problem of insect resistance to insecticides. The insecticide would reduce the population, and the chemosterilant would destroy reproductive ability of survivors. Natural selection for resistance would automatically be halted.

Another joint use might be to apply an insecticide in areas where immediate control is essential, and then follow with a chemosterilant to prevent the surviving insects from rebuilding their population.

ARS entomologists and chemists emphasize that much more research must be done before chemosterilants can be used safely and effectively against native insect populations. The chemists must find the desired compounds, and the entomologists must learn how, when, and where to apply chemosterilants to specific insects without creating hazards to humans, animals, crops, or wildlife.

Nobel Prizes 1961

Chemistry

➤ UNRAVELING the secret of how the green leaf utilizes the energy of the sun is a scientific goal as important in its probable consequences as the discovery of atomic energy itself.

The researchers recognized by the award of the 1961 Nobel Prize in Chemistry to Dr. Melvin Calvin of the University of California, Berkeley, are among the few intensive efforts at the solution of this great chemical mystery. Compared with the rewards that would come from an artificial duplication of nature's photosynthesis, the amount of money and brains being directed toward this problem is considered to be very small indeed.

Dr. Calvin has approached this problem from two ends: determining how the biological process utilizes the light energy and how food and other substances are formed. In his laboratory at the University of California he is now working on filling in the knowledge between these two extremes in the photosynthetic process.

The citation for the Nobel award was for research on the carbon dioxide assimilation in plants. Dr. Calvin showed that photosynthesis is similar, in reverse, to the process of respiration in animals.

Dr. Calvin spent more than ten years on photosynthetic research using radioactive carbon, trying to resolve the basic steps in the process, which sustains all life on earth. He has been able to trace the intricate chemical mechanism by which plants convert water, carbon dioxide and sunlig into sugars, proteins, carbohydrat and other energy-bearing materials.

With co-workers at the Universi of California, Dr. Calvin develope the method of using radioactive ca bon to follow the complex series chemical changes carbon dioxide go through in plants to build larger mol cules that eventually become bas foods for man and animals. He al prepared radioactive sugar for use this work.

Dr. Calvin began active investig tions in the field of nuclear chemist during World War II, when he serve as an adviser on the atomic bom project. In 1945 he established a r search group at the University California whose primary concern w to develop fields of study in whic radioisotopes — radioactive forms chemical elements such as carbon an hydrogen — could serve as tools f investigating fundamental problem in chemistry. Later Dr. Calvin worke out a method by which certain no radioactive oxygen atoms could traced through life processes by co verting them to another substanc which did show radioactivity. In th way, techniques used to detect radi isotopes of carbon and hydrogen cou be extended to oxygen as well, a d velopment which is extremely impo tant in the study of life processes.

Dr. Calvin's studies of the origi of life developed out of his researc in photosynthesis. Investigations the storage and use of energy

Photosynthesis Nobelist

Melvin Calvin

ants led Dr. Calvin to wonder how ese living systems had developed in ture. In order to trace the develop- ent of life Dr. Calvin has attempted in the laboratory to duplicate conditions as they were on the primitive earth. In these experiments some of the molecules essential to life, such as

amino acids, were produced from substances believed to be present in the atmosphere billions of years ago.

Dr. Calvin has had plans and dreams of a really adequate research effort on photosynthesis which would involve a considerable number of millions of dollars of support, comparable to the money that was spent making the atomic bomb and is now being spent on the extensive inquiry on th nature and cure of cancer.

The award of the Nobel Prize f photosynthesis research may cataly a large effort of this sort with ac quate financing from foundations.

Dr. Calvin, a professor of chem try, is director of the University's bi organic chemistry group at the Radi tion Laboratory.

Physics

➤ The two physicists who won this year's Nobel Prize in Physics each increased man's knowledge of the atomic nucleus, or core.

Dr. Robert Hofstadter, 46-year-old physics professor at Stanford University, Calif., was honored for his work using the Stanford linear accelerator to more clearly define the structure of the nucleus from the patterns produced when electrons are hurled at a hydrogen target.

Dr. Rudolf L. Mossbauer, now at California Institute of Technology, Pasadena, won the Nobel Prize for discovering in 1958 at the age of 30 that, under certain conditions, nuclei could emit or absorb gamma rays without any recoil, known as the "Mossbauer effect." Using this principle has already allowed scientists to confirm Einstein's principle of equivalence to determine the tiny magnetic field of the iron nucleus, and to provide the most accurate clock yet available.

Equally important is the promise of the Mossbauer effect in the field of solid-state physics, from which has come the transistor among other devices.

While at the Universities of M nich and Heidelberg, Dr. Mossbau showed that some nuclear gam rays of low energy could be emitt or absorbed without recoil if t atomic nuclei were tightly enou bound in solids and the temperatu reduced. Gamma rays are identical X-rays but are emitted from the nuc of atoms rather than from the ato electron cloud.

Binding the emitting or absorbi nuclei in a solid also eliminates t broadening due to motion of t atoms caused by heat. In this w radiation of phenomenally narr frequency spread is provided, as w as an absorber perfectly matched frequency.

The most recent result of the wo of Dr. Hofstadter and his co-work in probing the atomic nucleus is t two of the most fundamental buildi blocks of all matter appear to be v tually perfect mirror images of ea other. They are the proton, which a positively charged nuclear partic and the neutron, a neutral one.

The proton is pictured as essentia a tight core of positive electric cha surrounded by two larger, somew

iffuse and interpenetrating clouds, lso of positive charge. The clouds are ıade up of mesons, the nuclear par- cles believed to serve as the "glue" olding the nucleus together.

The neutron also has a hard core f positive charge surrounded by two iffuse and interpenetrating meson ouds. In this case, however, one oud is negatively charged while the other is positive and extends somewhat farther out from the hard core.

These pictures were selected as the best fit for experimental information gathered by Dr. Hofstadter and his co-workers from the scattering of electrons accelerated and hurled at hydrogen targets in the Stanford machine. They were "drawn" in terms of the distribution of electric charges within the nucleus.

Medical

This year's winner of the Nobel rize in Medicine, Dr. Georg von ekesy of Harvard University, is the orld's leading authority on the func- ons of the ear.

The 62-year-old Hungarian-born ientist is senior research fellow in sycho-physics at Harvard and is not rimarily a doctor of medicine al- ıough he holds an honorary M.D.

Dr. von Bekesy won the Nobel rize for his work on the physical echanism of stimulation within the ochlea, a cavity in the internal ear ıat resembles a snail shell. This vity contains the important organs hearing. These organs transform e vibrations received by way of the ıter and middle ear into nervous im- ılses that are transmitted to the ain for translation into sound.

Hearing authorities say Dr. von ekesy's outstanding contribution was his development of the automatic ıdiometer in 1947, by which a per- n can trace his own minimal hear- g level.

The von Bekesy type of audiometer being used in hearing laboratories to develop tests for tumors of the auditory nerve. In this way a diagnosis of the cochlear and retrocochlear (behind the cochlea) functions can be made.

Dr. von Bekesy worked for many years in the research laboratories of the Hungarian Telephone System. He became interested, he once said, in the human ear when an economist asked him whether an improvement could be expected in the telephone system.

Another question of how much better is the ear than the telephone inspired him to glue tiny mirrors to the eardrum and record its response to sharp impulses. Then he pursued the problem into the inner ear itself, where he recorded and measured the traveling wave as it went along the ear membrane.

Among numerous awards Dr. von Bekesy has received was one of eight given in 100 years by the American Otological Society. The latest came coincidentally at the time the Nobel Prize of $48,300 was announced, when the Deafness Research Foundation in New York gave him its Merit Award Medal.

√ *Chemistry Quiz* √

Directions: Mark the answer you think *most nearly correct.*
Answers are on page 20.

A. The best evidence to date indicates that the space between the stars is sparsely filled primarily with
1. tritium
2. oxygen
3. helium
4. hydrogen

B. Which of the following materials is used for control rods in the atomic pile?
1. antimony
2. boron
3. carbon
4. titanium

C. Rare earths occur in all of the following except
1. cecite
2. cinnabar
3. gadolinite
4. monazite

D. For which of the following products is the bulk of the sulfur mined used?
1. sulfuric acid
2. sulfa drugs
3. rubber
4. superphosphates

E. Mercury is used as a solvent in refining
1. aluminum
2. calcium
3. potassium
4. silver

On the Back Cover

➤ SILICONE RUBBER AFTER 9000°F. — *General Electric showed samples silicone rubber materials that had successfully withstood temperatures up 9000°F produced in an electric arc supersonic wind tunnel at the Company Missile and Space Vehicle Department in Philadelphia. The half-inch thi sample shown following tests is a material developed by G-E's Silicone Produc Department, Waterford, N. Y. Following exposure of six minutes, a ha carbonaceous crust formed on the surface, leaving 70 per cent of the rubb intact. G-E said the results of the tests suggested that silicone rubber materi could be considered for use as thermal coatings in missiles and space vehicl where other protective coatings or sealants could not operate.*

Highlights from the September Meeting of the American Institute of Chemical Engineers in Lake Placid, N. Y.

Foams Are Big Business

Foam Market to Hit 800 Million Pounds

THE NEXT FIVE years should be good es for the foam industry. Both con- mption and production will in- ease, and the industry will expand arkets in the building, marine, in- lation, electrical wiring, packaging, ctrical household refrigerator, com- ercial refrigerator, textile and carpet shioning fields.

This is indicated as the result of survey made by John C. Tallman, arketing Research Division, De- lopment Department, E. I. du Pont Nemours & Company, Wilming- n, Del., and was the subject of a per, The Foamed Organics Indus- , delivered at the 45th National eeting of the American Institute of hemical Engineers.

The survey, which included studies some 35 industries, was made at e request of four du Pont depart- ents that manufacture ingredients ed in the production of foams.

Mr. Tallman estimated that the de- and for foams in 1966 will be ap- oximately 800,000,000 pounds, and oduction will be some 740,000,000 unds, compared with 248,000,000 s year.

He advised the producers of foams and their ingredients to "look beyond imitative uses (where foam merely replaces some other material in the construction of a product) to imaginative use (where foam is designed into a product to capitalize on its unique properties and to permit economies in production costs). The greatest value of the imaginative approach will lie in the extension of foam properties and technology to applications where foams have never before been used."

Severe competition among producers of foams "has been both beneficial and detrimental to the long-range future of the industry." Benefits include development of improved properties, economic incentives for use of foams instead of traditional materials, and new outlets for foams "developed through the sheer necessity of disposing of increasing inventories."

Detrimental effects of competition have been "erosion of the profits of most foam producers," in some cases leading to "quality reductions which might damage the reputation of foams

and restrict their future growth."

Here's the 1966 picture as Mr. Tallman sees it:

Upholstered furniture: 140,000,000 pounds, which includes 80 million pounds of urethane foams, 50 million pounds of latex foams, and 10 million pounds of vinyl foams — accounting for about one third of all cushioned furniture.

The bedding industry: 100 million pounds, including 60 million pounds of urethane and 40 million pounds of latex foams.

Seat cushions for automobiles and trucks: 50 million pounds.

Other automotive uses: 80 million pounds for padding instrument panels, sun visors, arm rests, upholstery for doors and side panels, carpet underlay, gaskets, seals and weather stripping, and possibility for thermal and acoustical insulation.

The textile industry: 20 million pounds, including 15 million pounds for thermally insulated outerwear and 5 million pounds for handbags and luggage.

The building industry: 85 million pounds, including 55 million pounds of polystyrene foam and 30 million pounds of rigid urethanes, whi amounts "represent only a small fra tion of the potential market; estimat indicate that the long range potenti for foams in building insulation alo is over 1 billion pounds per year."

Mobile homes — house trailers: million pounds. Insulation for lo temperature warehouses, cold stora rooms, refrigerated railroad cars, r frigerated trucks and ships: 25 m lion pounds.

Electric household and commerci refrigerators: 50 million pounds.

Insulation for industrial piping an equipment: 25 million pounds.

Insulation for electric wiring: million pounds.

Packaging industry: 30 millio pounds.

Marine flotation products: 24 m lion pounds.

Fifteen other fields, includin acoustical insulation, air filters, ele tric potting and encapsulating con pounds, aircraft and missiles, railroa passenger cars, busses, shoes, flon and displays, houseware, industri gaskets and seals, and military: 9 million pounds.

New Epoxy Foam as Insulation Material

➤ A Shell Chemical Company research program has developed a new series of low density, rigid epoxy foams, whose features and competitive costs "suggest numerous applications within the appliance building, chemical, packaging and transportation industries, a Shell engineer reported to the 45th National Meetin of the American Institute of Chemic Engineers.

The foams "appear destined to b come a major factor in the dynam and rapidly growing foam field," J P. Toohy, New York, said in a pape Low Density Rigid Epoxy Foams.

"Although relatively new, compared ith other types of low density foams, oxy foams are finding increasing ceptance in all types of low tempera- re insulation. Epoxy foams are not ly competitive in cost to other types liquid foam systems, but are also nsiderably less toxic during the ap- ication phase."

Epoxy foams were first developed ore than 10 years ago as light weight sulation material for electronic com- nents. Since then continual progress as been made, with the foams being sed in the aircraft and electrical in- ustries, but their use has been some- hat limited by their handling char- teristics and their relatively high ensity range, "which prevented them om competing effectively on an eco- omic basis with both conventional sulation materials and with other pes of foams."

The new epoxy foams, according to Mr. Toohy, have "a much broader range of potential application than heretofore possible." The new foams are "reaction products of bisphenol-A (a polyhydroxyl compound) and epichlorohydrin (a propylene derivative).

Both the resin and the curing agent components of these foam systems "have excellent storage stability." The components do not tend to settle out nor will continuous exposure to the atmosphere cause the resin components to polymerize.

The foams are classified as "one-shot" systems, in that no intermediate chemical manufacturing step is necessary between the raw material and the end user to control the heat of reaction, excess vapors or resultant foam properties. "This assures the end user of uniform product quality for the complete foam system."

Plastic Largely Air

A PLASTIC, which was first intro- uced 14 years ago, but had a lagging arket, today is one of the fastest owing in its family.

The plastic is polystyrene foam. To- y "thanks to automatic molding achines, panel presses and extrusion stems, it is the fastest growing mem- r of the styrene family of plastics," . C. Kiessling, Koppers Company, onaca, Pa., told the 45th National eeting of the American Institute of hemical Engineers.

Commercial production facilities are ow turning out polystyrene insula- on board and foam core panels for the building trade, all types of protective packaging, insulation components for the refrigeration field, light weight containers, complete small boats and for many other applications.

"Yet, even today there are new processing techniques and applications being developed which promise an even greater future success for polystyrene foam," he said.

Mr. Kiessling said that this organic cellular material "has demonstrated its unique versatility in an ever growing number of successful applications. Industry sources estimate that a potential usage of over 90 million

pounds will be attained by 1965. . . ."

When this plastic was first introduced, its "unique combination of properties were readily apparent," but lack of satisfactory equipment for economical processing held its development back, he said.

As a result of its cellular structure, polystyrene foam "has many interesting physical characteristics. This structure, which consists of many tiny closed cells containing air, has a high ratio of air space to polystyrene material. The small amount of material in the foam accounts for the extremely low density of polystyrene foam. It also has very low thermal conductivity, and offers very good resistance to the transmission of water vapor and absorption of moisture.

Urethane Foam Making 'Great Strides'

➤ A COMPARATIVE johnny-come-lately material is making rapid headway in the automobile world, J. R. Wall, of Inland Division, General Motors Corporation, reported.

Mr. Wall, in a paper, A Continuous Process for Urethane Foam Prepolymer, told the 45th National Meeting of the American Institute of Chemical Engineers that urethane foam was first used by the automobile industry approximately four years ago and since has made "great strides," particularly for use in automobile seats.

Use of this material grew from 10,300,000 pounds in 1959 to 16,000,000 pounds this year, a gain of 56 per cent. "Another advance to 19,500,000 pounds is forecast for 1963."

Urethane foam "began to make inroads into the automotive seating field as a substitute for foam rubber," Mr. Wall said, "because it was a less expensive material, since it could be produced at much lower densities with comparable load-bearing properties."

Mr. Wall said that he looked "for this trend to continue, with urethane foam taking over more volume from cotton and curled hair, as well as foam rubber latex."

Urethane was first used in the automotive industry in a vinyl-covered instrument panel, but since has been used extensively in seat cushions and to a lesser degree in head liners and arm rests, he said.

New Frothing Process for Making Foam

➤ A NEW method of producing foam by frothing was described at the 45th National Meeting of the American Institute of Chemical Engineers. It was detailed by R. E. Knox, Elastomer Chemicals Department, E. I. du Pont de Nemours & Co., Wilmington, Del., in a paper, Frothing — A New Method for Producing Urethane Foam, presented at a symposium that surveyed the use and production of foams for automobile seats, insulation, boats, etc.

The foam frothing method "involves incorporating, at elevated pressures, volatile liquids, into a reactive polyurethane composition, which a

r mixing, is discharged to a lower essure with subsequent partial ex- nsion of the reacting materials."

The utilization of fluorocarbon 12 as "excellent" in obtaining resilient ethane foam frothing.

The new method produced a low nsity foam "comparable in quality" conventionally produced foam. ignificantly process improvement nging from lower moulding pres- res, lower overall density to better am stability, have been observed. he process and equipment have been boratory tested with limited field confirmation. These results show that frothing has both processing and economic potential."

The process "expands the possibility of this interesting class of materials . . . " Frothing develops the characteristics of conventional polyurethane systems, self generating gas and cure characteristics which are "both unique and desirable." It "reduces or eliminates many of the restrictive problems inherent in conventional polyurethane foaming," and is adaptable to existing foaming equipment and procedures.

'Breathability' Makes Latex Foam Popular

The attribute of "breathability" is ne of the important factors account- g for the popularity of latex foam bber, a United States Rubber Com- ny engineer said.

Latex foam's structure is character- ed by interconnecting cells which rmit passage of air upon flexing, dward C. Svendsen, Mishawaka, d., observed in a paper, The Manu- cture and Properties of Latex Foam. ne paper was read during the 45th ational Meeting of the American stitute of Chemical Engineers.

"This attribute, referred to as eathability, refutes the contention at rubber in contact with the body hot," he said. "The ventilation fea- re yields a cooling efect, and is per- ps one of the outstanding reasons r the demand in many applications latex foam."

The oroginal Dunlop process for aking latex foam has satisfied the mands made on the major part of e latex industry, but "a more recent process has become an important alternate procedure adopted by several companies." It is known as the freeze gel or Talalay process.

Natural latex for many years was the only latex available, but of recent years a synthetic latex has been developed.

"In spite of significant developments with synthetic latex, the natural material still makes up more than one third of the total amount consumed."

The cost of natural rubber "has been the determining factor in its loss of market," Mr. Svendsen said.

In the last 15 years the price of natural rubber has varied from about 33 cents a pound to more than 70 cents a dry pound.

Latex foam is widely used as seats, cushions and pillows, among other things, and is "an important product of commerce that has 25 years of public acceptance and confidence," he said.

Close Liaison of Scientists and Engineers

➤ Close "design liaison" between research scientists and design engineers is "one of the most important considerations" in planning a research and development project, the American Institute of Chemical Engineers was informed.

Research and development projects differ from other projects in several ways, K. A. Clark, General Electric Company, Richland, Wash., pointed out in a paper, Project Engineering For Research and Development. Such projects should incorporate plans for expansion and versatility. "Programs are constantly changing and the same facility might be used for several purposes. The frontiers of science are constantly expanding so space must be provided for newer and different equipment which multiply the avenues of progress for any particular task . . . Another consideration . . . is the practicability of beneficial use and occupancy of part of the facility for a critical program while the remainder is being completed."

In liaison between research scientists and design engineers, "sometimes the best purposes are served when the scientist takes the time and effort to write equipment specifications and prepare work sheets for equipment design that is unique to his particular program. Close adherence to these criteria in detailed design can materially reduce design costs and expedite design completion."

When planning a new facility, budget study "frequently brings light deficiencies in prior planning."

There are certain advantages in th use of a cost-plus-fee contractor f expediting construction before the d sign package is complete, Mr. Cla said. On small jobs the work may accomplished in much shorter tim Sometimes the fixed-fee payment smaller than the cost of extras resu ing from changes to a fixed-price co tract. "Cost-plus contracts are especia ly useful in the installation of equi ment where it is difficult to define e actly what will be required of t contractor before the work begins."

Mr. Clark warned that availabili of equipment for a new purpose process should be "thoroughly chec ed" before specifying in a contract estimating for a proposal, as in son cases vendor catalogues and represe tatives "lead one to believe that a vanced equipment or material is ava able that is only in the developme stage or has been discontinued."

It also "is advisable to conduct safety review of each segment" of proposed new facility. "The safe engineer, customer, technical repr entative, and project engineer shou make a critical inspection for hazar and make recommendations for th elimination or control. Project fun should be allotted to correct any su hazards deemed the responsibility the project engineer."

Housewife Major Marketing Factor

The housewife is becoming a ime marketing factor in a "major volution" taking place in the chemi- l industry.

This was emphasized at a market- g symposium during the 45th Na- onal Meeting of the American Insti- te of Chemical Engineers, by T. P. orbath and N. B. Sommer of Amer- an Cyanamid Company, in a paper, he Changing Times in Commercial hemical Development.

"We perceive a trend in which clear it lines of demarcation between in- ustries are disappearing — the chem- al company no longer just makes emicals — the steel industry no nger only steel, nor the oil industry ly petroleum products. Our chemi- l business more and more has begun fabricate its raw products and to arket these end products to the re- ilers and consumer — necessitating hole new concepts of operation.

"Major emphasis is on marketing rategy with the elements of adver- ing and promotion looming large the struggle to do the best job of urting our favorite consumer, the usewife."

The authors warned, however, that in this "major revolution," lie pitfalls in which the "proverbial green grass across the fence may be assuming its fall colors prematurely with the red ink of the accountant if sound judgement is not used along the way."

"In particular, the importance of learning properly to market to the consumer must be emphasized if we are to be successful in courting Mrs. Housewife. Selling to this unpredictable lady and to the buyer at Macy's is greatly different from calling on a purchasing agent in a chemical company. We must learn the effective use of advertising and promotion and we must be willing to appropriate the funds to enoble us to accomplish this. We must be marketers first and technical and production people second."

They stressed the importance of developing and producing good products, but this "may not be as important as an advance in packaging or a step forward in making the product more convenient to use."

Another "major pitfall" is the danger of developing and marketing a product which would be in direct competition with the company's other customers.

Small Company Has Best Chance

The small chemical company has e best chance for success with new oducts in new markets, the Ameri- n Institute of Chemical Engineers as told in a paper, How Market evelopment Looks to a Small Com- ny.

The paper, describing Pygmakon, an imaginary small chemical company, was presented at a marketing symposium by James H. Boyd, a consulting chemical engineer and adjunct professor at Columbia University, New York. Pygmakon is a company

whose annual sales are about $2,000,000 compared with billion dollar sales of some of the giants in the industry.

"Only in the cases of a new market opening up for a new product can market developments have any chance for major rewards for Pygmakon," Mr. Boyd said.

"What should Pygmakon do?

"The answer is — get out and sell! Selling a new product exposes it to competition. This is the testing needed to determine its chance for survival. If it survives then it may have growth potential. Selling will determine this. If the new product sells and sales grow, it can become entrenched in use so that when competition is aroused and becomes active the competitive products are at a disadvanta to displace the established produ Pygmakon has obtained a time a vantage which if exploited is difficu to overcome.

"This is most effective developme of a market for a new product by small company. It is active and dire market development in the mark place with a minimum of risk . . . is market development by selling."

He described Pygmakon as "a co posite image of the critical stage number of smaller growing chemic companies have passed through." Py makon "is truly a pigmy, albeit agile, vigorous and intelligent, co pared with the giants, with ability grow," he said.

Compressors 'Heart of the Process'

➤ Compressors may form only a small part of the machinery in a chemical process plant but they frequently are "the heart of the process," and their "availability" may be the difference in profit or loss.

This was stressed at an economics of equipment selection symposium during the 45th National Meeting of the American Institute of Chemical Engineers.

"Availability" was defined as the on-stream factor, by D. J. Metroka and H. A. Weigand, of the Ingersoll-Rand Company, New York, in a paper, Selection of Reciprocating Compressors For Minimum Investment Consistant With Maximum Return.

"Many process concerns have emphasized a policy to reduce the capital outlay," they observed. "This, of course, is good business practice, b if it is consistent in maintaining maximum return on the initial inve ment. The most expensive plant own is not one which requires t greatest capital expenditure, but t one which which refuses to pay oft

After summarizing the cost of compressor, "the purchaser shou next check the return which can expected from the machine. Ma times this part of the economic co parison is glossed over or omitte Actually, in a chemical process the a dition of this evaluation may pla initial capital cost differences in startlingly different light.

"Although the compressor may a small part of the total plant, in mc cases the process ceases to produce the gas stops flowing. Stoppage of t

achine may, therefore, idle a large vestment. The actual function of the mpressor is of tremendous impor- nce.

"A primary measure of a compres- r's ability to return its investment is s expected on-stream factor — or ore specifically — its availability. In rder to return the investment quick- , this should be extremely high, and is suggested that both user and anufacturer should shoot for the im- ossible 100%. On-stream factor is atio of logged operating hours com- ared to the total time interval under nsideration. Compressor availability the ratio of the time that the ma- ine is in condition to return the in- estment, deducting any period for epair, inspection, or replacement of arts, compared to the total time pe- riod. The availability of all components within the process must approach 100% if the expected complete plant on-stream factor is to be high."

A one per cent difference in the expected availability "should make a substantial difference in the selection of equipment." They observed that in a refinery expansion of some $20,000,000, the reciprocating compressors will cost almost a million dollars and "are the heart of the process." Assuming a write-off of two years, this means $28,000 payout will be lost for each day the compressors fail to keep the process in operation. Over only two years a difference of 1% expected availability will amount to seven days additional on-stream time, or a gain of almost $2,000,000. This is equal to 20% of the price of the compressors."

CPPS Technique Used in Process Industries

CPPS PLAYED a role in bringing the olaris Missile to an operational basis ell ahead of schedule. It also was tilized to develop on a crash basis e Minuteman Intercontinental Bal- stic Missile (ICBM) and it has been sed to help engineer and construct y-scrapers, bridges, power plants, eel mills, chemical plants, etc., "in more economic manner than here- fore."

CPPS, Critical Path Planning and cheduling, was described "as a pro- ct management tool or technique at makes possible large economies the engineering and construction projects of all types. It was so escribed in a paper, The Application Critical Path Planning and Schedul- ing to Engineering and Construction, prepared by L. B. Glaser and Relph M. Young, of the Lummus Co., New York, for delivery at the 45th National Meeting of the American Institute of Chemical Engineers. The method "is an application of the basic mathematics employed to solve network problems and enables a project manager to ascertain the precise status of his project at any given time."

The authors warned, however that "it is not a panacea for the project management function, but is an effective tool that, when properly used, enables the project manager to plan his project in much more detail than has been practical before, determine the most economic way to carry out

the project plan, and then effectively monitor the plan to achieve the goals set for cost and schedule."

They added that CPPS is not "a substitute for technical experience, qualified personnel, creative thinking, sound judgment, good labor relations, and the like. But when used in combination with these factors we have found it to be a valuable project management technique in the economic engineering and construction of process plants.

"As to the future, we see the CPP technique being used more and more for cost and process reporting, for storing and retrieving vital project information, for conducting unit-cost analysis, and the like — all aimed at providing the means to enable us to render a more effective service to the process industries."

Radioactive Wastes Disposal Efficient

➤ In three years of operation the pressurized water reactor of the Duquesne Light Company at Shippingport, Pa., has discharged only 20 per cent of radioactive waste it was designed for, the 45th National Meeting of the American Institute of Chemical Engineers was told. In the three years there has been no incident when radioactivity was discharged into the Ohio River or the atmosphere in greater quantities than specified by the National Bureau of Standards, C. S. Abrams, W. J. Hahn and J. R. La Pointe, of the Westinghouse Electric Company, Pittsburgh, reported in a paper, Evaluation of the Performance of the Radioactive Waste Disposal System at the Shippingport Station.

This three-year period covers a complete cycle of operation for a pressurized water reactor plant from initial operation through a refueling operation and back to power operation," they said. "A basic principle of the waste disposal system at Shippingport is the segregation of wastes to take full advantage of the particular capabilities of several disposal processes. Basic waste disposal treatments include natural decay of radioactive materials, ion exchange, dilution in turbine condenser effluent stream, separation of radioactive materials from waste by a standard evaporation process, retaining certain solid wastes at the plant site in underground storage tanks, incineration of certain wastes and packaging of wastes for land burial.

Under an agreement with the Commonwealth of Pennsylvania, a maximum of 6,200 uc per day and yearly average of 1,590 uc per day of radioactive materials may be discharged into the Ohio River. The maximum microcuries discharged into the river was slightly over 10,000 in October 1960.

"The operation of the Shippingport plant thus far has been characterized by coolant fission product activity levels considerably lower than the waste disposal system was designed to handle, they commented.

Nuclear Contaminants

The elaborate steps taken to prevent radionuclides from entering the environment, including the Columbia River, at the Plutonium Recycle Test Reactor at the Hanford Laboratories, Richland, Wash., were detailed at the 55th National Meeting of the American Institute of Chemical Engineers. The safety precautions were related by W. A. Haney, G. E. Backman and D. R. Koberg, of General Electric Company, in a paper, Liquid Waste Management Planning for the Plutonium Recycle Test Reactor.

The reactor is "inherently safe" and was designed "to contain radioactive materials released in a plausible nuclear incident," they said.

Waste disposal limits and monitoring facilities have been established "to prevent the chronic discharge of excessive amounts of radionuclides to the environment. "Waste streams leaving the site are monitored and discharged under controlled conditions and process solutions which might enter the waste through equipment failure "are monitored and treated to insure that a minimum potential exists for the contamination of waste streams."

"The basic criteria for the design and operation" of the reactor waste disposal facilities "were developed to assure that self-imposed limits — even more stringent than those promulgated by responsible authorities — will not be exceeded."

The control limit on the principal manhole was set at 5 millicuries per cubic centimeter, on the basis that, iodine 131 in the effluent with a total radionuclide of that concentration "would not result in a thyroid dose in excess of one rad to a child consuming river water downstream" of the reactor site.

Such an exposure, they said "is well within the recommendations of the International Commission on Radiological Protection for a year's dose to the thyroid of persons not occupationally exposed to radiation. Also assumptions relative to river flow, isotope ratios and water consumption used in arriving at the recommended limit were well on the conservative side." (A rad is one hundred ergs of absorbed energy per gram of absorbing material.)

The reactor is shut down for varying periods when the concentration of radioisotopes reaches MPC_w (maximum permissible concentration in water) for drinking water in the neighborhood of controlled areas.

Concentration limits are based on "conservative considerations between the waste monitoring station and the first downstream use of Columbia River water as a source of sanitary drinking water supply for Pasco, Wash.," a few miles downstream.

"The contributions of PRTR to the fraction of non-occupational MPC_w at Pasco during periods of normal reactor operation are estimated at less than 0.001 per cent. Any contaminat present under these conditions will be due to the presence of activation products in the shield coolant stream."

Gas to Ease Shortage of Water

➤ THE REFRIGERANTS used in your air conditioner and refrigerator may play an important role in easing the expected world-wide shortage of potable water, the American Institute of Chemical Engineers was informed during their 45th National Meeting.

Freon-31, Freon-21, methyl bromide, Freon-142B and Freon-12B1 "appear to be useful" in the hydrate process for desalting sea water, Allen J. Barduhn, Howard E. Towlson and Yee-Chien Hu, of the Department of Chemical Engineering and Metallurgy, Syracuse University, reported in a paper, The Properties of Some New Gas Hydrates and Their Use in Demineralizing Sea Water.

The paper was a report on an investigation that was inaugurated in July, 1959 "to determine the critical decomposition temperature and pressure of hydrates not previously reported, to determine more completely the thermodynamic relations for those hydrates that appear promising for use in desalting, and to determine other properties of the systems necessary for an economic evaluation of the process such as composition and rate of formation of the hydrate and solubility of the agent in water."

The paper described the hydrate process as a "comparatively new" one "in which pure water is separated from its solutions in a solid form by a reaction with certain agents to produce a gas hydrate." It was the subject of a recent article in Chemical Engineering Progress which told about the use of propane as a hydrate.

The hydrate process "is quite similar to the freezing process in which a direct contact refrigerant is used, in that heat is removed from salt water by evaporating a refrigerant intimately mixed with it to produce a solid form of water (ice or hydrate) free of salt, which is subsequently separated from adhering brine, and then melted by condensing the compressed refrigerant on it. The hydrate process thus accrues many of the advantages of the freezing process, such as absence of scale formation, very low temperature differences required for heat transfer, absence of membranes, etc. In addition, it has certain advantages over the freezing process mainly due to the fact that it operates at higher temperatures."

Messrs, Barduhn, Towlson and Hu discovered eight hydrates during their study.

√ Answers to CHEMISTRY QUIZ on page 8.
A - 4; B - 2; C - 2; D - 1; E - 4. √

Highlights from the First Symposium of Radioecology at the Colorado State University in Fort Collins, Colorado

NEW RADIATION STUDY APPROACH

A NEW approach to studying radiation effects on animals using the population, rather than the individual, has resulted in some significant findings for a Michigan scientist.

A study by Dr. J. S. Marshall, assistant research limnologist with the University of Michigan at Ann Arbor, has revealed that less than fatal doses of radiation have these effects on daphnia:

1. Although the death rate was not affected significantly, the birth rate was reduced significantly.

2. Increases in radiation intensity resulted in a decrease in the proportion of immature individuals, and an increase in the proportion of middle aged adults. The proportion of young adults was relatively unaffected.

3. Individual growth increased with increasing dose rate.

Dr. Marshall said his findings with daphnia — a minute water creature related to the shrimp — could not be projected to other species or humans. But the population approach would be valuable in studies of other species, he points out.

"Most previous studies have considered only the effect of radiation upon the individual or the average individual and not the population as a whole. This is the first study on the effects of radiation on such things as age distribution within the population," he explained.

The reason for the increased proportion of older individuals among the daphnia is that low doses of radiation — below the fatal level — first affected reproduction. This also accounted for the increased growth.

"In daphnia, the eggs are rather large in relation to the animal that produces them. Apparently the energy that goes into reproduction goes into growth when radiation halts the reproductive processes," Dr. Marshall said.

Scientists See No Radiation Hazards

IF THE testing of nuclear weapons continues with no greater frequency and magnitude than in the past, fallout is not likely to present any hazard, two scientists attending a symposium on radioecology said.

Agreeing that past fallout and radiation studies have shown no measurable biological effects on man's environment were Dr. K. H. Larson, Environmental Radiation Division, Laboratory of Nuclear Medicine and

Radiation Biology, University of California, and Dr. John N. Wolfe, head of the Atomic Energy Commission's Environmental Science Branch.

In a morning press conference, Dr. Wolfe noted that in early tests all of the emphasis was on what effect the tests might have on man. He said that military necessity probably was the reason that little emphasis was placed on environmental studies prior to the early tests.

More recently — since 1947 — increased emphasis has been placed on the effort to find out what effect fallout has on man's environment, Dr. Larson said.

In this connection it was pointed out that recent Russian weapons testing will make it necessary to repeat certain phases of environmental studies being conducted in Alaska by the United States.

Radiation Has Beneficial Uses

➤ All radiation is not evil. Although the effects of radiation are generally thought as harmful, radiation has been used to produce improved varieties of flowers, a barley variety that grows and matures inside the Arctic Circle and an Hibiscus plant that will grow 1,000 miles farther north than the parent plant.

Dr. John D. Spikes, University of Utah biologist speaking at the Radioecology symposium cited these and other beneficial results of radiation as a scientific tool.

In the experimental stage, Dr. Spikes said, is the use of radiation to prevent sprouting of onions and potatoes in order to improve their keeping qualities.

Generally, high dosages of radiation are harmful to plants but different plants react differently. Coniferous evergreens are killed in a season or two when radiated with only five roentgens (a radiation measurement) each day. Gladioli can withstand 5,000 to 6,000 roentgens of radiation each day through the growing season, he said.

One of the advantages of radiation in plant breeding is the production of mutations, Dr. Spikes said. Mutations — hereditary changes — occur naturally in plants but not very often. Radiation of seeds, parts of plants and entire plants causes more frequent mutation than normal and gives plant breeders wider use of experimental plant material in a much shorter time than would occur naturally.

A rust resistant oat variety was developed from a mutation caused by radiation. It took three years for the scientists to develop the variety.

Under natural conditions it would have taken the scientists eight to ten years to develop the variety because of the slowness of plants to mutate naturally, he said.

In the field of plant biology, radiation offers scientists a tool to learn more of the intricate process of photosynthesis plant metabolism, uptake of nutrients, and the transmission of plant diseases.

Lethal Radiation Dose

It is now possible to predict the mount of radiation living cells can vithstand, a Brookhaven National .aboratory scientist said.

He is Dr. A. H. Sparrow who poke at the first radioecology sym- osium on the Colorado State Uni- ersity Campus.

He said he predicted lethal dosage an be applied equally to cells of lants and animals but that it works nly with cells in a single bit of tissue. t still doesn't tell how much radia- ion a human can take because the uman body is made up of many dif- erent kinds of tissue containing cells nat vary in the amount of radiation ney can withstand.

Generally the amount of radiation a ell can withstand depends on the size f its nucleus, he said. He likened the ucleus to a target and the radiation ource to a rifle. The larger the target, the more bullets that are likely to hit it, he said.

There are other things that determine the amount of radiation a cell can withstand. One is the time between cell divisions and another is the number and size of chromosomes within the cell.

Most of the cereal grains used for food in the United States can withstand large doses of radiation without being killed.

"They will survive in case of an atomic attack if there is anyone left to work the land," Dr. Sparrow said.

Some of the plants that can take the greatest amount of radiation without being killed are those of the cabbage family — the cauliflowers, turnips, rutabagas.

The greatset immediate value of the discovery of how to predict lethal dose rates for cells is in its use in the laboratory and in teaching, he said.

Answers on Radiation Tolerance Level Needed

It is not known whether suggested olerance levels to radiation are too onservative, too liberal — or even hether they may be beneficial to life - an Atomic Energy Commission ophysicist declared.

P. S. Henshaw of Washington, .C., said tolerance levels have been t in the range of 10 to 100 times ckground radiation levels. Based on bservations of animals' manifest gor, it is believed that lasting injury produced by daily exposures substantially more than a 1000 times background level.

There is the greatest need for criteria and methods to determine tolerance levels, he declared.

Henshaw addressed the opening session of the First Symposium on Radioecology.

Calling attention to the perils of reckless and inconsiderate use of atomic energy on the animal species, Henshaw quoted the late ecologist, Aldo Leopold.

Leopold said: "Land despoliation has evicted nations and can, on occasion do it again. A harmonious relation to land is more intricate and of more consequence to civilization than historians seem to realize."

Resources despoliation can resul not only from wanton and greed consumption, but also from contam nation of the environment with de structive agents such as ionizing radia tions, Henshaw added.

Radiation Has Minimal Effect

➤ Danger from considerable doses of radiation is virtually non-consequential — provided you're a micro-organism.

In other words, those minute beings floating around in the water and buried in the soil are likely to survive exposure to radiation which could destroy the higher forms of life — including humans.

These findings reported by a pair of scientists — James B. Lackey of the University of Florida and Carrie F. Bennett of the University of Califor-

nia — at the first symposium on radio ecology on the campus of Colorad State University.

Further, the scientists reported, "w have not seen one single instance c morphological change in any micr organism in several years of exper ments."

That is, micro-organisms such a tiny bacteria, are unconcerned — an to an extent unaffcted — by radiatio

The report was based on studies b the two in both the field and labora tory with a number of micro-organisn species.

Strontium 90 Buildup in Bones of Deer

➤ Tests conducted in California from 1952 to 1960 showed a definite increase in the amount of strontium 90 found in the jawbones of deer, it was reported at the First Symposium on Radioecology.

The findings were reported in a scientific paper prepared by V. Schultz of the U.S. Atomic Energy Commission and W. M. Longhurst of the University of California.

The tests were conducted with yearling Columbia black-tailed deer in Mendocino county, California, about 70 miles north of the San Francisco Bay area.

Although further sampling is nee ed, it appears that the peak of stron tium 90 accumulation following ce sation of nuclear testing has bee reached, the scientists reported. Spec mens taken in 1961 are now bein analyzed and results should clarif this point, they added.

In earlier sessions of the sympos um, it was pointed out that suc accumulations of strontium 90 in th bones of animals are well known Unknown, other scientists have ind cated, is just what the accumulatio may mean biologically. The answe to that question will take much mor time and much more study, they sai

Fallout Shelters Defer Death

Under conditions of nuclear war, allout shelters might only defer death or populations whose environment as been made untenable by high adiation levels, an Atomic Energy Commission scientist said.

In the keynote address to scientists ssembled at Colorado State Univer- ty for the First Symposium on adioecology, Dr. John N. Wolfe, ead of AEC's Environmental Science ranch, pointed out that whenever an's environment has been made ncompatible with his existence he as had to emigrate or perish. Thus, man has "no place to go," fallout elters might offer only temporary espite from death, Dr. Wolfe said.

At the same time, he emphasized at at the radiation levels thus far easured "we can find no biological ffects" on man or the plant and animal life on which his existence depends. This does not mean, he said, that no such effects exist. It merely means that much more must be learned about atomic radiation before those effects can be measured with any degree of certainty.

A great deal of information on such things as the Strontium 90 levels in the bones of creatures has been gathered, but none on what it means. Later it may be possible to determine what the effects are, but it will take time. Currently, any lethal effects would not show up in natural populations because if mutants were found it would not be possible to determine whether they were due to radiation, Dr. Wolfe said.

Short of nuclear war, man's existence and the use of atomic energy are not incompatible, he concluded.

Study of Plutonium Effects

Two California scientists urged ad- itional research on plutonium and s effects upon animals and plants the First Symposium on Radio- ology.

Dr. H. K. Larson and Dr. J. H. lafson of the University of Califor- ia's Daboratory of Nuclear Medicine nd Radiation Biology, Los Angeles, id that while on one should be armed about the concentrations of utonium 239 in th environment of an, more answers about the effect this extremely hazardous material e needed.

Pointing out that the plutonium 239 isotope is superior as a nuclear fuel, it is destined to play an increasingly important role. Research indicates plutonium 239 radiation shortens the life span and induces bone tumors.

Reviewing research on plutonium, the Californians said it has been a part of our environment throughout history in extremely minute amounts. Measurable amounts have been present in soils and biological materials only since the first man-made plutonium was released in 1945.

Inhalation is considered as the primary source of entry for plutonium into mammals, the doctors said. Eating plutonium contaminated foods is considered a minor source.

Plutonium in the body is absorbed slowly by the body. Once is enters the blood stream, however, it is rapidly deposited in various body tissues, particularly bones and the liver. Elimination of plutonium from the system is a slow process.

Only small amounts of plutonium are found in the air, the scientists said. It is believed that only in a very small area at the immediate site of a nuclear detonation would the air contain more plutonium than man's to erance levels.

"Plutonium is a long lived isotop It has a half life of 24,400 years. Tha is, it would take 24,400 years for on half the isotopes to decay naturall so they are no longer radioactive, the pair explained. "The effective ha time in man has been estimated t be about 200 years.

Because of this long life, it is po sible that present concentrations a only the beginning of a continuous rising trend. While the situation encouraging, based on present know ledge, a much greater understandin of environmental reactions is neede they concluded.

Fallout Over Sea Heavier

➤ Nuclear fallout appears to be heavier over the sea than on land, two Massachusetts scientists told the First Symposium on Radioecology.

Coastal soils show higher fallout than do those sampled remote from the coast, according to findings of Dr. Vaughn T. Bowen of the Woods Hole Oceanographic Institution in Massachusetts and Dr. Thomas T. Sugihara of Clark University, Worcester.

"It becomes possible . . . that the high apparent fallout over the sea is not, as first suspected, simply a consequence of the sea surface being the ideal fallout collector," the scientists reported. "Two other possibilities are evident: either the mechanics of oceanic high pressure cells results in preferential return to the troposphere of stratospheric air over the oceans, or there is some basic difference in the process of fallout collection on prec pitation over the ocean, resulting i higher efficiency."

The scientists speculated that stro tium 90 must be involved in the fu circulatory cycle of the oceans, that i penetration to depths, by whatev process, must finally and repeatedly b followed by return to the upper layer It is our prejudice, they said, thoug the data are still scant, that this r turn has begun to be seen.

Over very wide areas of ocean, the pointed out, which had for two yea absorbed high fallout without muc if any, rise in surface Strontium 9 in late 1959 and 1960 these valu took a sharp and significant jum Especially in view of the reductio in fallout rate due to test moratorium this was hard to explain, they co tended.

Sea-Derived Food Less Radioactive

If both land and sea areas are qually contaminated by radioactivity, od derived from the sea would be ss likely to have adverse effects on an, according to marine biologists tending the first symposium on dioecology at Colorado State Uni-rsity.

Citing results of studies conducted veral years ago in the Pacific nu-ear weapons testing area, the scien-sts said that the ocean has a "dilut-g effect" on radioactive isotopes of rontium 90. Conversely, marine life ows a higher concentration of iso-pes from other elements, but these ements are shorter lived than stron-um and hence not as critical a factor.

Marine life also tends to "discrimi-ate" against the uptake of strontium. addition, in a reaction occurring hen a nuclear test is made, stronti-um tends to be precipitated out with calcium hydroxide and much of it falls quickly to the bottom of the sea, the scientist added.

They emphasized that no genetic abnormalities had been noted in fish examined during the studies. They described silt made up of tons of particles falling back on the surface of the sea as probably the "greatest killing agent for marine life," due to the smothering action occurring as the silt moves back and forth with the ocean currents.

Discussing the studies were A. H. Seymour, Paul R. Olson, F. G. Lowman and R. F. Palumbo, all of whom were with the University of Washington, Seattle, at the time the tests were conducted. Palumbo has since taken a position in Puerto Rico.

Protecting Resources From Radiation

Immediate steps must be taken to sure re-establishment of our natural vironment — both plants and ani-als — following either a nuclear "ac-dent" or an all-out atomic war, an mory University scientist said.

Dr. Robert B. Platt of Emory Uni-rsity, Atlanta, Ga., said that pro-sions must be made — possibly in e form of a modern-day "Noah's rk" — reconstituting all elements of ir environment if we are to achieve tisfactory recovery from a thermo-uclear disaster.

Speaking at the first Symposium on Radioecology at Colorado State University, Dr. Platt described as "fallacy" the notion that "if we can provide protection for the human . . . that all else will also be provided for."

He emphasized that now is the time to initiate studies that will lead to actual planning for the preservation of all phases of environment.

Dr. Platt recommended the possible use of "transient irradiators" — devices to irradiate varied areas of the environment — as valuable methods for compiling an inventory of plant and animal radiation sensitivity.

With this knowledge in hand, he said, plans could then be made for shielding the vital members of our "biological economy."

Dr. Platt also urged the creation of a "study group concerned with the reconstitution of our biological economy following thermonuclear war."

He said the traditional historical approach to recovery of life, which dictates that nature will repair its losses, is not practical in the face of thermonuclear war.

He called for the experimental approach — introduction of carefully controlled radiation into certain areas of the environment, observing the results, and then acting in accordance with gathered information.

Other scientists reported on research projects designed to measure the sensitivity of certain trees to radiation.

J. E. Giddens, also of Emory University, said that in a Georgia test area doses of mixed neutron-gamma radiation had "a pronounced effect" on the time at which hardwoods dropped their leaves. A summer dose of 15,000 "rads" caused leaves to tur brown and drop seven weeks ahea of the normal fall drop and almo completely inhibited leaf productic the following year, he said. A less summer dose of 4,000 rads resulte in leaves falling only a week early - and those leaves showed the norm autumnal color change. In the latt case, however, total leaf productic the following year was reduced b 39 percent.

The controlled radiation levels which the tests were conducted, a though described as "relatively low were many times higher than norm background levels now generally e isting, it was emphasized.

In similar controlled radiation tes on pine trees in Virginia, discolor tion, death of terminal buds and i hibition of reproduction occurred aft the trees were exposed to about 1,00 rads. Greater radiation dosages resu ed in complete browning defoliatic and death, according to R. A. Pedig of the College of William and Mary.

Radioactivity Surveys on Air, Food

➤ The U. S. Public Health Service has intensified its work in a nationwide network of detection stations to spot potential health threats from radioactivity.

Dr. Francis J. Weber of Washington, D.C., chief of the services' radiological division, reported on some of these developments. Dr. Weber, a former Denverite, attended the First Symposium on Radioecology held on the Colorado State University campus.

In the last year, the number of mi sampling stations operated by th Public Health Service was increase from 10 to 60. The agency is coopera ing with local and state health o ganizations in the operation of 45 a sampling stations throughout the n tion, Dr. Weber said.

More than 100 stations are checkin water for radioactivity through th National Water Quality Netwon Both radio and chemical analyses a made on milk and water to determi

e amount of radioactivity and to entify the specific types of isotopes esent.

"Particular emphasis is placed upon entifying strontium, cesium, and io- ne isotopes, some of the longer lived pes which are believed to be a threat health," Dr. Weber explained.

While there has been no increase in e number of laboratories, the service doing more sampling of food, he id. One of the current projects is to termine how much radioactive ma- ial is consumed in the average diet. Dr. Weber said the amount of dioactivity found in food, water and e air, has been running well under e safe levels.

Dr. Weber says he personally feels that if there is continued weapons testing in the world for a period of time, these safe standards would be exceeded. And if these standards are exceeded for sometime, radioactivity could pose a threat even for the present generation.

"Fall out is a product of the size of explosion. From 1945 until 1958, all of the nuclear tests in the world totaled the equivalent of 178 megatons of TNT.

"We now read that Russia is considering testing 100 megaton weapons. Detonation of two of these would create more radioactive fallout than there has been in all previous tests," he concluded.

Nature Filters Isotopes

While some mountain snow banks e especially efficient in concentrating lout isotopes, little radioactive ma- ial is found in the runoff water om these banks.

This was the conclusion of William Osburn, University of Colorado ientist who has made a study of the uation on 11,400-foot Niwot Ridge Boulder county. Osburn reported findings at the First Symposium Radioecology.

During the melting period, water rcolates down into the snow and ns out at the base of the snow bank, burn explained. During this period, topes cling to dust, accumulated ter and small organisms in the snow nk and there is little radioactivity the water.

After the meltwater leaves the snow d, it flows through a sedge mat, which also functions as a chemical-mechanical sieve to filter out litter and fallout isotopes. Nearly all of the fallout materials are trapped in the sedge mat, he said.

"The sedge mat which filters out the isotopes could do so indefinitely, even if the level of nuclear contamination were exceeded many fold," Osburn declared. "Often there is another sedge area at water reservoirs, so that water going into mountain storage lakes is particularly low in radioactive isotopes."

There are two threats to this natural filtration system, however, Osburn said. One is that if a cloudburst should occur immediately after the snowbank melts, much of the radiation-loaded litter that has not yet been incorporated into the soil would be washed out into lower areas.

Another problem is that the low amount of escaping radioactivity in water might emanate from one or two long-lived isotopes which are of great concern to man. If this isotope happened to be Strontium 90 or some other long-lived nuclide that might become concentrated in man's food chain, the low Beta activity of the water would not be a reliable indic tion of potential hazard.

Osburn suggests that the distrib tion of specific isotopes should checked as thoroughly as gross Be activity. He also called for studies other mountain snow banks to obta a total fallout concentration and lease picture for high mountain area

Disposal of Peaceful Atomic Wastes

➤ Except in the case of a disaster such as an earthquake or sabotage, solid atomic wastes buried in the ground are not likely to affect man's environment outside the disposal area, two scientists told the First Symposium on Radioecology.

The paper was prepared by Dr. Donald W. Pritchard, director of the Chesapeake Bay Institute of the Johns Hopkins University and Arnold B. Joseph, sanitary engineer for the U.S. Atomic Energy Commission and delivered by Dr. Joseph.

Some radioactive waste is released to the atmosphere through peaceful uses of atomic energy, Joseph said, but concentrations from this source are relatively low.

The amount of atomic activity which could be potentially released to the sea or incorporated in marine plant and animal life from packaged wastes (again from peaceful uses) is small compared to the fallout from weapons testing, Joseph said.

"Only in the case of unconfined discharge of liquid wastes to the sea has there been any measurable concentration of radionuclides in the marine environment which could be attrib ed to waste disposal operations," seph said. "These activities have be shown not to exceed the safety nor for man established by competent r tional and international advis councils and committees. No ve evident impact on the marine envir ment itself has been observed for t cases where relatively large amou of activity reach the sea. Detection any subtle changes in the character distribution of the marine plant a animal life must await the results long-term studies."

Dr. Joseph defined three gene sources of atomic wastes from pea ful uses of atomic energy: reacto fuel processing plants and license The wastes are liquid, solid and a borne. Some progress has been ma he said, in converting the wastes use in Systems for Nuclear Auxili Power (SNAP), however these vices in time, become waste-produci mechanisms, requiring disposal.

As of last December, he said, United States has $7 billion in nucl plant facilities, 160 operating react all involving problems of waste posal.

Serum Amino Acids

Bernard S. Rappaport, 17, was a winner in the 20th Science Talent Search. In this report he tells of the use of chemical techniques he used in doing his project.

by Bernard S. Rappaport

New Dorp High School, Staten Island, New York

The free amino acids in serum ay a prominent role in the human omeostatic mechanism, and their uantitative levels may be altered in ecific disease states. My many basic periments with paper chromatogphy and related articles which I ad in various medical journals made e aware of the increasing impornce of paper chromatography in edical research. I therefore decided devise a chromatographic technique r the quantitative analysis of human rum free amino acids, and to apply is technique to the possible diagosis of diseases related to amino acid etabolism.

echnique Development

The technique consists primarily of cerpts from three published chemil procedures, to which I added sevral modifications based on my origil theories.

— *Chromatography*

A solution of several amino acids placed on a rectangular piece of ter paper. The paper is suspended a glass chamber and separation of e several amino acids is accomished in two directions using ienol/distilled water and butanol/etic acid/distilled water as the two solvents. The paper is sprayed with a ninhydrin solution which reveals the location of each individual amino acid as a purple spot.

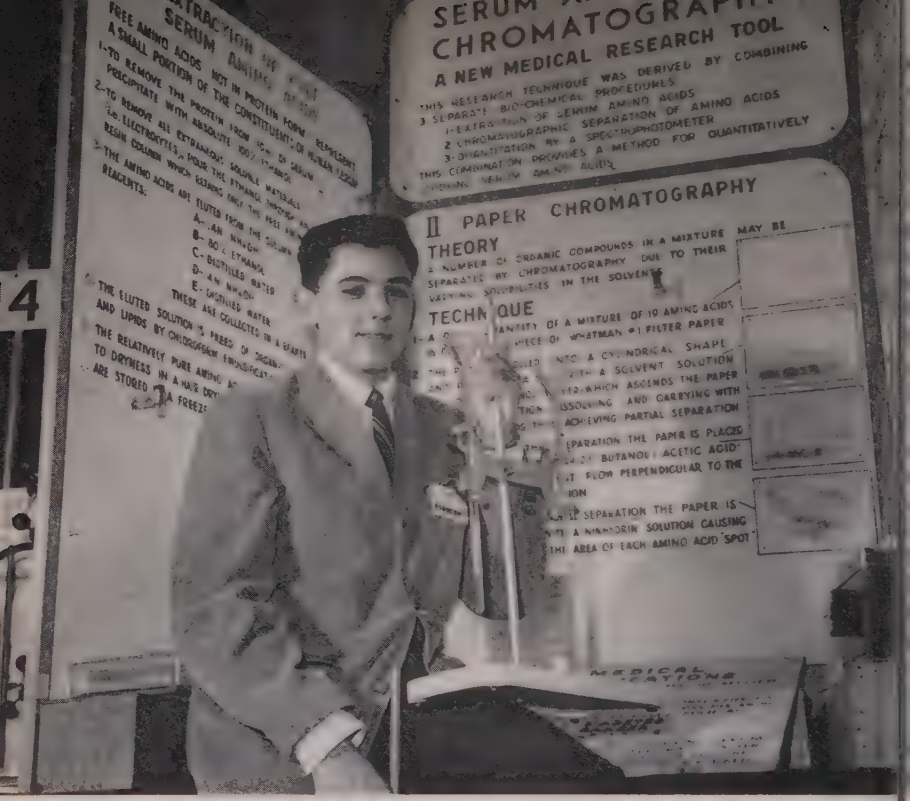
B — *Quantitation:*

Each spot on the developed chromatogram is cut out, the purple color eluted from the spot with ethanol, and the optical density if this colored solution is determined in a Beckman spectrophotometer. The concentration of each amino acid on the paper is directly proportional to the optical density of the colored spot. (This was proved by comparing the optical density of several spots of the same amino acid, in varying concentrations.) I made graphs of each amino acid showing the linear correlation between concentration and optical density.

C — *Extraction:*

Having thus made *standard curves* of the standard laboratory amino acids, I was ready to quantitate free amino acids extracted from serum.

Ethanol is added to the serum sample to precipitate the protein. The mixture is centrifuged and the protein discarded; the supernatant fluid contains the *free* amino acids. This fluid is passed through an ion exchange column which retains only the serum free amino acids, eliminating unwant-



➤ Bernard S. Rappaport *shows his science display at an exhibition held Washington as a feature of the twentieth annual Science Talent Institu Bernard was one of the 40 winners who were chosen from over 29,000 hi school seniors throughout the country.*

ed serum components. The amino acids are eluted from the column with ethanol and ammonium hydroxide. The eluate is evaporated to obtain the pure, dry, crystal, serum free amino acids.

This dried sample is reconstituted with isopropanol and chromatographed as previously described. Each amino acid spot is identified by comparison with a chromatogram of standard amino acids. The serum amino acids are then quantitated, as outline using the appropriate graph.

Modifications

The preliminary experimentati with the techniques was done in r home laboratory. It was therefore i perative that the technique, wherev possible, employ fairly inexpensi equipment.

— A — Conventional methods e ploy expensive chromatography cha

ers to accommodate full length filter aper sheets. Having studied the heory of paper chromatography, I ypothesized that the position of the lter paper is not related to the effec- ve separation of substances by chro- atography; that the paper may be n any position which allows the sol- ent to ascend the paper and separate he amino acids. Experimenting with ıy hypothesis, I placed an amino acid ixture on one filter paper which I olled into a cylinder. As a control, placed an equal volume of the same olution on another paper which re- ained at full length. Both papers ere placed in an expensive chroma- ography chamber which I borrowed. he papers were chromatographed. he cylindrical paper gave separations lentical to those obtained on the full ngth paper. Continued trials of this ontrolled experiment confirmed my ypothesis. This enabled me to use ylindrical papers, placed in inexpen- ve gallon pickle jars to obtain accu- ate chromatographic separations.

lair Dryer

- B — The literature suggests the se of vacuum desiccators (which are ostly and time consuming) for the aporation of the lute, described un- er *Extraction*. I hypothesized that nce the sole purpose of evaporating e eluate is to obtain the amino acids dry, crystal form, a vacuum is no ore effective than a direct stream of r. Experimenting, I performed the tire technique on two separate ali- uots of one serum sample. A home ir dryer was used to evaporate the uate of one aliquot; a borrowed cuum desiccator was used as a con- ol to evaporate the eluate of the her. Identical quantitative results were obtained in the two cases; the hair dryer technique was sixty-eight hours shorter. Repeated identical experiments thus confirmed my hypothesis. This enabled me to reduce the cost and time required for this phase of the technique by using a commercial home hair dryer.

— C — In choosing the conditions for the chromatography phase of the technique, I tried some of the suggestions in the literature, including various temperatures, the use of ammonium hydroxide in the chamber to contract the amino acid spots, various solvent mixtures, and different filter papers. In my preliminary experiments, some of the papers were marked by a black discoloration. Using the notes I had made of the conditions under which each paper was chromatographed, I did a series of chromatograms — varying one condition on each paper (i.e. a change in temperature, ammonium hydroxide concentration, solvent mixture, or filter paper.) The paper which was chromatographed with a lower concentration of ammonium hydroxide exhibited less discoloration. On the next chromatogram I eliminated the use of ammonium hydroxide in the chamber and the discoloration disappeared. As the ammonium hydroxide was the variable altered on that paper, it was conclusively proven to be the cause of the discoloration.

For the subsequent chromatograms I eliminated the ammonium hydroxide and chose the combination of variables which provided the best results.

Applications

Having thus devised a method by which the free amino acids in human

serum may be quantitated, I sought opportunities to test the applicability of the technique to clinical research studies.

— A — Under the provisions of an Alfred P. Sloan Foundation grant, I became a member of a research team at the Division of Surgical Research at Harlem Hospital, N. Y., during the summer of 1960. This team had been formed to investigate the free amino acids in the problem of delirium tremens, which is a major, and often fatal, complication of many surgical patients.

Delirium Tremens

Most of the delirium tremens patients were chronic alcoholics and all had sustained a severe trauma of post-operative shock. The technique previously described, with the exception of the use of their chromatography chambers, was employed in the research. A survey was made of the quantitative free serum amino acid levels of the following patient classifications: chronic alcoholic, pre-surgical, post-surgical, and post-trauma patients. The technique demonstrated that delirium tremens patients had absolute deficiencies of many of the amino acids. Based on this finding, commercial preparations of amino acids and related compounds (e.g. L-monosodium glutamate, N-acetyl-d-glucosamine, and L-arginine) were administered intravenously by doctors. The curative results were encouraging.

The technique was also employed in testing the prophylactic applications of amino acid therapy. Patients whose amino acid levels were low, as demonstrated by the technique, were administered one of the commercial medications. Delirium tremens di not develop in most of the cases.

— B — I am presently continuing th study of the technique's applicatio — at the U.S. Public Health Servic Hospital on Staten Island. I have ap plied the technique to the successfu quantitation of the free amino acic in urine. I am therefore establishing pilot project to determine the appl cability of the technique to large sca clinical surveys of serum and urin free amino acids. If the techniqu continues to give reproductive, acc rate quantitative results, I plan to e pand the pilot project. The expande research project would include a broa survey of the quantitative levels of th serum and urine free amino acids i apparently normal individuals and i patients with specific diseases. Th literature indicates that diseases suc as amino-aciduria, cystinosis, pheny ketonuria, hepatic coma, and Fa coni's Syndrome would be fruitfu areas for this investigation. All these diseases are marked by an i crease or decrease of the levels specific free amino acids in the urin and/or serum of the patient. I a also continuing my efforts to decrea the money and time required by th technique with the hope of increasin its applicability, on a large scale, i the clinical diagnostic laboratory.

Summary

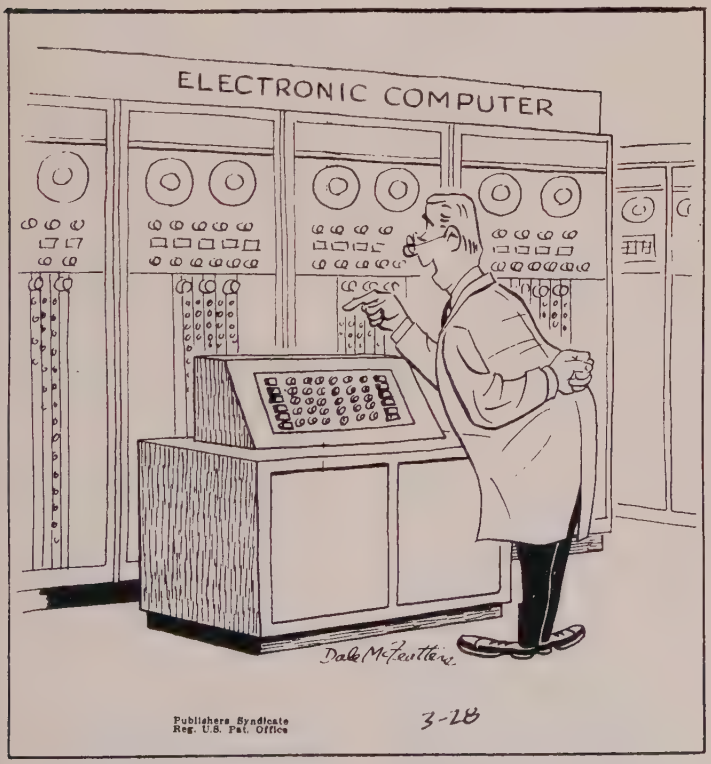
The technique, consisting of thr chemical procedures and some orig nal modifications, may be used for quantitative study of free amino aci in human urine and serum. Th technique is accurate to within range of ±5 per cent.

The technique has been successfull

pplied to a research study of the cure nd prevention of delirium tremens, sing amino acid therapy.

The technique is presently being pplied to a study of clinical syn- romes marked by an alteration of ie urine and serum amino acid levels.

The increasing importance of similar techniques in medical research indicates that this technique, if successful in my present research, may be applied on a large-scale basis as a quick, inexpensive, accurate diagnostic tool.



"Eenie, meenie, minie, mo — which button makes you go?"

Radiation Preserves Foods

➤ A NEW METHOD of preserving food which will make available fresh fish in areas far from the sea and fresh tropical fruit out of season is close to commercial testing.

Dr. Paul C. Aebersold, director of the office of isotopes development of the United States Atomic Energy Commission, Washington, told the Tenth Pacific Science Congress that mild doses of radiation can be used to reduce the growth of bacteria for weeks in perishable foods. This promises to compete with canning and frozen food in the near future.

The "low dosage" preservation of food, also known as radiation pasteurization, promises to be particularly important in the event of limited wars in which U.S. troops may be engaged in the future. Soldiers in the front line areas could be supplied with otherwise perishable foods without refrigeration.

An immediate commercial application is used on strawberries, which can be prevented from molding for weeks by low level radiation. The radiation is cheaply and simply available from some of the by-products of atomic reactors.

In India tests have shown that the ripening of mangoes can be delayed and this tropical fruit, usually not available to areas without refrigeration, can be made available widely in the future. Since for religious reasons, meat is not widely eaten in India and mangoes have excellent protein and nutrient qualities, this should be a major contribution to the Indian diet.

Another advantage to low dos preservation is that any larvae dangerous insects would be killed b this method. For that reason frui that otherwise could not be shippe into areas like the United States woul be made safe for marketing.

For radiation pasteurization, a fe thousand rads are necessary, which only about one-tenth to a hundred of the more massive radiation dos used in the food sterilization that th U.S. Army Quartermaster Corps investigating. A rad is a unit measu ing radiation somewhat similar t roentgens which are used to measu X-ray dosage. A rad produces 10 ergs of radiant energy per gram the material being irradiated.

The apparatus for irradiating foo probably in the future will be used i the food processing plants or even i the fields where the crops are bein harvested.

The Atomic Energy Commission undertaking a five-year study of th new food preservation method an experiments are underway at th Massachusetts Institute of Technolog Cambridge, Mass., at Seattle, and th University of California Agricultur Experiment Station at Davis.

The low-dosage irradiation suppl ments the work the U.S. Army Qua termaster Corps is doing at Natic Mass., on high dosages of radiatio capable of completely destroying ba teria, permitting food preservatio without refrigeration for many month and years.

Algol Yellow R

by Burton L. Hawk

Last month we discussed the prep- ation of anthraquinone from anthra- ne. If you have made this product, u may use it now for the prepara- on of Algol Yellow R, a typical vat e of the anthraquinone group.

For best results, the crude anthra- inone should be purified by sub- nation, as described in the previous ticle. The material should be in the rm of light yellow, fluffy crystals. fter you are finished you should ve accumulated about ½ gram of oduct.

initroanthraquinone

The first step involves the prepara- n of 1:5-dinitroanthraquinone. Dis- lve the entire quantity of anthra- inone (about ½ gram) in 5 cc of ncentrated sulfuric acid. Stir until e crystals are completely dissolved. hen slowly add ½ gram of powder- sodium nitrate. Add the compound small quantities, stirring rapidly er each addition. It is now neces- y that the mixture be kept at a mperature between 60 and 80° for eriod of 12 hours. We suggest that u transfer the mixture to a small sk and immerse the flask in a larger ntainer partially filled with water. sert a thermometer in the water ntained in the larger vessel. Place e whole apparatus over a very small me or on a hot plate regulated so t the temperature will stay within e 60 to 80° range.

After the 12 hour period has elapsed, remove the flask from the heat and pour the contents in 50 cc of water in a beaker. Stir rapidly. A precipitate consisting of a mixture of 1:5-dinitro- anthraquinone and 1:8-dinitroanthra- quinone separates out of solution. The 1:5-dinitroanthraquinone is soluble in alcohol. Therefore, to separate the two compounds, add 70 cc of alcohol, stir thoroughly for a few minutes and then filter. Pour the filterate into an evaporating dish and set aside in a warm place to allow the liquid to evaporate.

Diamino-anthraquinone

The next step involves the preparation of diamino-anthraquinone. Place all of the 1:5-dinitroanthraquinone you have prepared (which won't be very much) in a beaker and carefully add a solution of 2½ grams sodium sulfide dissolved in 15 cc of water. Stir and apply heat. Gradually bring the mixture to boiling. The solution will turn dark bluish-violet in color and will thicken. This is due to the separation of diamino-anthraquinone and sulfur. Scrape the precipitate off the filter paper and dissolve in alcohol. It may be necessary to heat the alcohol to dissolve as much of the product as possible. Filter again. Since the diamino compound is insoluble in water, it may be precipitated by adding water to the alcoholic filtrate and separated by filtration. The filtrate is again allowed to evaporate, leaving behind the scarlet red diamino-anthra- quinone.

Now, if we have not lost you somewhere along the way, we will proceed with the preparation of the dye. Add about ½ gram of benzoyl chloride (caution — handle carefully) and 2½ grams of dimethylaniline to the entire quantity of the diamino-anthraquinone which you have prepared (which won't be very much). Boil the entire mixture until the benzoyl derivative separates out as a yellow-brown powder. This should require about ½ hour. Finally, the product is filtered. Algol Yellow R is a yellowish powder technically known as 1:5-di(benzoylamino)anthraquinone.

As we stated previously Algol Yellow R is a typical example of a group of Algol dyes obtained from anthraquinone which are vat dyes. Vat dyes are insoluble in water, but on reduction they yield alkali compounds which are soluble. These compounds are readily taken up by fibers.

When the cloth is exposed to the air, the reduced compound is again converted to the dye which becomes very fast due to its insolubility in water.

Thus, in using a vat dye it is first reduced by an alkaline solution of sodium hyposulfite. The material to be dyed is immersed in this solution and then exposed to the air. Vat dyes are available in a variety of attractive shades.

Diabetics' Hearts Benefit

➤ Anti-diabetes drugs taken by mouth are under investigation for protecting diabetics against heart trouble, it was reported at the American Chemical Society meeting.

Oral anti-diabetes drugs decreased cholesterol synthesis in rat liver, Dr. Hugh J. McDonald of Loyola University, Chicago, said. High levels of cholesterol in the blood are believed by some to be responsible for the development of atherosclerosis, he explained.

It cannot be definitely established that the oral anti-diabetes drugs lower the levels of blood cholesterol in diabetics and protect them from atherosclerosis without extensive clinical studies, Dr. McDonald cautioned. The findings with the rat liver tissue are only preliminary, he said.

The anti-diabetes drugs cannot be used against atherosclerosis in non-diabetics, in spite of the extreme importance of this medical problem, because the drugs cause a drastic lowering of blood sugar levels. It is quite possible, however, he added, that the findings will point the way to the development of drugs that would be effective against atherosclerosis without affecting blood sugar levels. Such drugs might be used in non-diabetic patients.

The effects on cholesterol synthesis of oral agents now available to the public have not previously been reported. In fact it had even been suspected that the drugs might be helping the patient's diabetic condition but at the same time exposing him to the bad effects of increased blood cholesterol levels, Dr. McDonald said.

Market names of the drugs being tested are orinase, debinase and DB

pparatus Article

Two-Dial Torsion Balance

THE SEARCH for new analgesics at istol-Myers research laboratory in illside, N. J. entails repeated weighgs of synthetic organic compounds. ccess depends on finding the mediily active material from among an most infinite number of such comunds. To save time and labor lab chnicans now use a two-dial weighting torsion balance that yields gnificantly faster weighings with the quired accuracy.

Thirty or more sample quantities of 5 to 50 grams are weighed per day at the Hillside lab on the compact and convenient two-dial balance. Weighing time is substantially less than with the beam-and-slide-weight balances previously used. Biggest timesavers are the dials developed by The Torsion Balance Company, Clifton, N. J. to load weights and make finer adjustments without arresting the balance. Conventional slide-weight bal-

ances must be arrested between each fine adjustment, adding two time-consuming hand motions to the operation.

For example, a typical weighing operation at the Bristol-Myers lab would involve the yield of an organic synthesis of roughly 47.7 grams. Flask and flask holder weigh, let us say, 100 grams. Placing a 100-gram weight in the right pan, the weight loading dial can be turned up in one motion immediately from 0 up to 50 grams without arresting and before the pointer swings over. This dial is returned to 40 grams by a simple twist and fine weighing is dialed in up to 7.7 grams, again continuously and without arresting the balance. Pointer swings are damped rapidly by a silicone fluid dash-pot for even faster readings. With a beam-and-slide weight balance at least three weights would have to be added to the right pan with arrests in between. The slide weight would then be moved up to 7.7 grams in at least six more motions, stopping each time to bring the balance to rest.

The 500-gram capacity torsion balance used in this lab is accurate to 50 mg — more than enough for most routine weighings in organic chemistry. By using dials for weight loading and fine weighing the Torsion DWL-5 balance minimizes the possibility of metric weights becoming inaccurate through excessive or rough handling.

In addition, the torsion mechanism which eliminates the wearing of knife edges, has retained its accuracy after more than one million weighings in laboratory tests. Other torsion balances have been used by the Bristol-Myers research laboratory in similar work for eight years and longer without requiring service or presenting any serious difficulty.

Process Removes Strontium-90 From Milk

➤ Should the United States be hit by a nuclear attack, the milk supply, at least, could be made safe. The Agricultural Research Service, the Atomic Energy Commission and the U.S. Public Health Service have developed a process that removes 98% of the strontium-90 from milk.

The technique used in a complicated version of the water softening process: Citric acid is added to cold raw milk to ionize all the strontium. (Without the acid, only 60% of the strontium would be in ionized form.) The milk-acid mixture is then poured through tall columns containing an ion-exchange resin that essentially snatches the strontium ions out of the milk as it flows by.

The remaining steps are mere clean-up chemistry: The milk is treated with potassium hydroxide (an alkali) to neutralize the acid, then pasteurized and homogenized. Water added with the acid and alkali is removed by flash heating the milk in a vacuum chamber.

The process is now being tested on a pilot-plant basis at the U.S. Department of Agriculture's research center in Beltsville, Md., the developers reported in Agricultural Research.

New Chemical Patents

To obtain copies of these new patents, order them by number from the Commissioner of Patents, Washington 25, D. C. Enclose 25 cents in coin, money order or Patent Office Coupon (but not stamps) for each patent ordered.

tonation Waves and emical Reactions

IT HAS BEEN found that the unusual nditions of pressure and tempera- re existing in a detonation make is phenomenon ideal for the promo- n of chemical reactions. The tem- rature, gas velocity, ignition char- teristics and composition of the oducts of a detonation wave are termined primarily by the composi- n of the detonable material.

When an acetylene-oxygen mixture used with an oxygen/carbon atomic io of one, the resulting atmosphere slightly carburizing or reducing vards many substances. This ratio o produces the highest flame ve- ity and temperature. Ratios less an one produce more strongly car- rizing or reducing atmospheres ile ratios higher than one produce idizing atmospheres.

U.S. Patent No. 3,004,822 was is- ed to Richard M. Poorman and orge P. Hawley of Speedway and Herbert B. Sargent of Indianapolis, d., for their invention of a meth- for utilizing detonation waves to ect chemical reactions. They have igned the patent to Union Carbide rporation of New York.

They have utilized this method for the carburization of tungsten and molybdenum and for the reduction of iron oxide. In their invention they have improved the operating efficiency of the detonation gun by providing specially controlled combustion zones in the various areas of the gun.

Gas Centrifuge for Isotope Separation

➤ MECHANICAL gas centrifuges have been used for the separation of isotopes. In these centrifuges the rotation of a centrifugal drum provides a centrifugal force that acts upon the gas mass. This force causes a concentration of the heavier isotope towards the wall of the drum with a corresponding concentration of the lighter isotope towards the axis of the drum.

Karl Steimel of Konigstein, Germany has been awarded U.S. Patent No. 3,004,158 for a gas centrifuge which provides a centrifugal force due to the movement of a gas mass in a stationary drum due to the interaction of a magnetic field and a gas discharge current. He has assigned this patent to Licentia Patent-Verwal tungs-G.m.b.H. of Hamburg, Germany.

In this invention only a fraction of the gas molecules in the gas mass

need to be ionized due to the fact that the whole gas mass is made to move by the presence of a relatively small number of gaseous ions. This effects quite a savings in electrical energy over that required in the known electromagnet mass separators.

With this invention, circumferential velocities of the rotating gas mass greatly exceed those obtained in a gas centrifuge with a rotary drum. This increase in velocity permits a great increase in the separating effect of the centrifuge.

Cellulose Film By Cuprammonium

➤ The usual process for manufacturing regenerated cellulose film by the cuprammonium process consists extruding the viscous cuprammonium cellulose spinning solution through a narrow slit into an alkaline aqueous coagulating bath. The extruded and coagulated film is then drawn through an acid "decoppering" bath to remove copper. The film is then washed and dried.

This process produces a film in which the cellulose molecules are oriented longitudinally in such a way due to the excessive stretching of the film as to give low transverse stability and a small degree of extensibility. The finished film also has an undesirable variation in properties from the middle to the edges.

A new process for the production of regenerated cellulose film that avoids these difficulties has been invented by Herbert Koren, Franz Hoelkeskamp and Paul Schubert of Wuppertal-Langerfeld and Rolf Linder of Wuppertal-Barmen, Germany. They were awarded U.S. Patent N 2,962,765 for their invention. Th assigned the patent to J. P. Bemb Aktiengesellschaft of Wuppertal-Ob barmen, Germany.

In the new process, the cupramm nium cellulose film is forced throu an extrusion slot and conveyed on roller at a speed about equal to t extrusion speed. The film is conduct through the alkaline bath and the ac bath at low speeds to avoid longi dinal stretching.

Two Infrared Detecting Systems

➤ Dr. John Strong of Johns Hd kins University, Baltimore, won tent No. 3,005,913 for an infra range finder. Rights were assigned the U. S. Army. He found an i proved method for detecting and cating distant objects that, althou invisible, send out weak infrared diation. Objects such as ships hidd by fog, haze, smoke screens or da ness could be detected by the ra finder.

The instrument is like a conv tional optical range finder except t it works for infrared radiation, usi bolometers as detectors and electro circuits for translating the detec radiations into indications of angle.

William Feldman and Harry Fra Hicks, Jr., Rochester, N. Y., w awarded patent No. 3,005,914 fo new method of detecting the infra radiation focused on a bolometer means of a fixed optical system. T assigned patent rights to the U. Navy.

Origin of Volcanoes

The modern concepts of how the different shapes and structures of volcanoes originate are different from the ideas that have been given in the older geology and chemical books.

The modern concepts as to how e magma or rock melt is generated thin the earth, how it changes its mposition during its ascent to the rface to extrude as lava, and how e different shapes and structures of lcanoes originate were told by Dr. sashi Kuno, of the University of kyo's Geological Institute at the nth Pacific Science Congress at nolulu.

The Hawaiian volcanoes are largely ilt up by repeated outpouring of id lava without being accompanied th violent explosions. As a conse- ence gentle-sloped flat mountains e formed.

Most Japanese and other volcanoes und the Pacific are built up by ernate outpouring of lava and ex- sive eruptions of fragmental ma- ials such as ash and pumice from e central crater. Thus the steep- ped cones such as Fuji-san, Japan, produced. Powerful explosions used by high concentration of gas viscous magma is a common feature activity in these cones, which often ult in loss of human lives such as the case of 1952 explosion of a marine volcano Myozin-syo, south Tokyo, and also devastate arable lands. Where magma is extremely viscous, it protrudes to the surface as a nearly solidified column of lava as was witnessed in the birth of Syowa-sin-zan in Hokkaido, Japan, in 1945. As a result of combination of these different types of eruptions, many circum-Pacific volcanoes have rather complicated structures and irregular topography.

Hawaiian lavas are mostly black basalt. Chemical analyses show that they contain about 50% SiO_2 The circum-Pacific volcanoes are made up of various types of rocks: black basalt, grey andesite with about 60% SiO_2, light-grey dacite and rhyolite with about 70% SiO_2.

It has been observed that more SiO_2-rich magmas tend to be lower in temperature and more viscous, and to contain more dissolved gas, mainly H_2O. These differences of physical and chemical properties of magmas cause difference of type of volcanic eruptions.

How are these different magmas generated is the fundamental problem in volcanology.

Seismologists believe that no permanent layer of magma exists with the earth down to the depth of 2900 kilo-

meters from the surface. Most probably, therefore, the magma is generated locally and temporarily by melting of solid rocks. The depth of generation of the magma appears to lie between several tens of kilometers and several hundred kilometers from the surface. This magma is of basaltic composition like the lavas of Kilauea and Mauna Loa, Hawaii. The heat energy necessary for melting the solid rocks is supplied by a slow convection current which is supposed to occur within the mantle of the earth.

The basalt magma thus generated rises to shallower depths, perhaps several kilometers from the surface, and forms a reservoir from which the materials to be erupted to the surface to form the volcanoes are directly supplied.

The magma within the reservoir then undergoes cooling, and crystallization of various minerals begins. Because these minerals are heavier than the magma from which they crystallize, they gradually sink toward the bottom of the reservoir. As this process goes on, the magma in the upper part of the reservoir becomes more and more enriched those components which the minera do not contain or contain in small proportions. The minerals contain a whole more MgO and CaO than the magma, and therefore SiO_2, alk lies (Na_2O and K_2O), and volat substances, chiefly H_2O, are succ sively concentrated in the residu magma. This explains why the SiO rich magmas (dacitic and rhyoliti are lower in temperature than t SiO_2-poor basaltic magmas.

If the proportion of SiO_2 (a Al_2O_3) is high relative to Mg FeO, and Ca), the atomic ratio Si Al : O in the magma is close to 1 whereas if the proportion is low, t ratio is close to 1:3. If the ratio close to 1:2, more O ions would shared by Si and Al ions, resultin in higher degree of polymerization the linked Si, Al — O groups whi form the framework of the silica structure. The higher degree of po merization combined with the low temperature of the SiO_2-rich magm results in the higher viscosity. If t content of dissolved gas increases such viscous magmas, powerful e plosion may happen.

Canned Beef Tastes Fresh

➤ CANNED BEEF that looks and tastes fresh has been produced through the use of sulfur dioxide, the American Chemical Society at Chicago was told.

The new technique, which is inexpensive, permits the preparation of beef for canning by fast cooking at low temperature, which does not te to cause toughness or stringiness, a cording to a report by Professor S. Block of the University of Flori department of chemical engineerin Although five per cent sulfur dioxi was used in most of the experimen

rk, samples retained their natural vor and texture after nine months en only .3 per cent was used, he d. Spoilage and bacterial growth re prevented.

During canning, meat ordinarily is led for 3 hours and then cooked another hour under pressure to bacteria. Such vigorous treatment toughen muscle fibers, dissolve connective tissue between the ers, and leave the meat stringy watery, Professor Block told the S Division of Agricultural and od Chemistry.

"The work does not attempt to pro- e a practical working formula for mmercial meat preservation with fur dioxide, but merely demon- ates the preservative value of sulfur xide in meat and calls attention to possibility of a simple, inexpensive, l effective method for preservation meat in cans while retaining the te properties of freshly cooked meat, Block said.

Sulfur dioxide is widely used to serve acid fruits, but its value in serving meat has not previously n investigated, it was explained. hen acetic acid was added, the ef- tiveness of sulfur dioxide was pro- ged, the chemical engineer said, ling:

One-inch cubes of beef were cook- at 175-200 degrees Fahrenheit for minutes in 8-ounce Mason jars, ped and incubated at 98 and 115 rees Fahrenheit. Without preserva- , the meat was invariably spoiled 3 days.

With .05 per cent SO_2 spoilage delayed up to 6 months, and with .1 per cent some samples were unspoiled and without change in taste at 9 months. Samples with .3 per cent were all preserved at 9 months. Spores of *Clostridium orogenes* bacteria added to or injected into the beef were not killed by the preservative, but the bacteria did not proliferate when the jars were incubated.

"To increase the efficiency of preservation with sulfur dioxide, acetic acid could be added to lower the pH (alkalinity) of the beef after cooking without an acid taste being detected."

Since 5 per cent sulfur dioxide seemed to be the most satisfactory amount, this percentage was used as a criterion in studying other influential factors. At that concentration 710 parts per million of sulfur dioxide was detected in juice and 86 parts per million in drained cooked meat.

"Since volume of meat and juice is roughly equal after cooking, the average quantity of sulfur dioxide for the whole sample was about 400 parts per million.

"Consumption of one-half pound of meat per day preserved with 1,000 parts per million of sulfur dioxide would lead to ingestion of 0.227 grams. Health authorities would have to ascertain whether this quantity would be harmful if taken for long periods.

"Preservation with sulfur dioxide permits meat to be canned under time and temperature schedules that do not overcook the meat and which produce a quality cooked meat product."

A. L. Martinez, and Jean Bevis, also of the University of Florida were co-authors of the paper.

Proudly Presented

Announcing new developments in the chemical industry and newly available chemical literature.

High Vacuum Pumps Components Brochure

➤ HIGH vacuum pumps and components are the subjects of a new six-page, illustrated brochure recently published by Central Scientific Company, a division of Cenco Instruments Corp.

Described in detail is the Cenco series of two-stage Hyvac Vacuum Pumps ranging from 21 to 140 liters per minute. The pumps in this series work on a concentric rotor-rotating vane principle which significantly reduces noise and vibration.

Hyvac Pumps have a vacuum guarantee to better than 0.0001 mm. of mercury. The pump can be disassembled on location by inexperienced personnel without special tools in case small foreign objects are accidentally ingested or the interior of the pump is chemically contaminated.

Also detailed in the brochure are several Cenco high vacuum system components: the light weight, shatterproof Aluminum Safety Bell Jar; the Magnetic Stirrer for the stirring of liquids under vacuum conditions; and the Electronic Discharge Vacuum Gage.

Copies of the high vacuum pumps brochure are available by writing for "New Ideas from Cenco," Booklet #2, Central Scientific Company, a division of Cenco Instruments Corporation, 1700 West Irving Park Road, Chicago 13, Illinois, U.S.A.

Urethane Coatings Provide Superior Leather Products

➤ SHOES, luggage, and other leath goods with greatly superior scuff sistance, flexibility, and gloss rete tion are now being produced fro side leather and patent leather coat with urethane finishes.

Harsh flexing tests show that pate and side leather treated with uretha coatings resist cracking 10 to 20 tim longer than leather coated with co ventional leather finishes, says P Maloney, Manager of Urethane D velopment for Trancoa Chemical C poration, Reading, Mass. Tranc specializes in urethane resins for co ings and adhesives and will tai urethane resins to fit customer requi ments.

Mr. Maloney points out that scu resistant urethane-coated leather tains glossy appearance two to th times longer than leather protected regular finishes. Urethane leath coatings are not softened, dulled, otherwise affected by wet or win weather, he adds.

Leather finishers apply uretha coatings by a spray or by a "flow-co method which involves running lea er sides under a V-shaped trou through which the coating flows. C or two coats are usually applied patent leather. Each coat is dried b baking for two or three hours at abo 150° F. Patent leather for wome and children's shoes is presently

gest application of urethane leather shes.

ide leather normally receives one thane coat to upgrade the leather ility. If a relatively rigid coating is ired, the finish is force-dried in a minutes. For a flexible finish, the thane film is force-dried for a few irs.

Total thickness of urethane coatings patent leather averages 1 to 4 mils. ethane film thickness on side leath- normally is less than 1 mil.

For more information on urethane her coatings, write Department R. 2, Allied Chemical Corporation, Rector Street, New York 6, N. Y.

perties of Infrared nsmitting Materials

NFORMATIVE 4-page folder on the operties of infrared transmitting terials is offered by Servo Corpora- of America.

The folder reviews 15 materials, viding transmission curves and de- ed properties on each. Among the properties covered are long wavelength transmission limit in microns; index of refraction; cold water solubility; soluble solutions; maximum size; and relative cost.

Copies may be obtained by writing Serve Corporation of America, 111 New South Road, Hicksville, L. I., N. Y.

Micro-Carbon Dioxide Determination Procedure

➤ NEW 8-PAGE methodology report available from Technicon Instruments Corporation describes procedure for automatic, continuous determination of carbon dioxide in biological fluids on as little as 0.05 ml. of specimen.

The micro-CO_2 procedure can be run at the rate of 40 determinations per hour and applies to both serum and plasma.

A complete rundown is provided on sample preparation and color reagents. A detailed flow diagram is included.

Copies can be obtained by writing Technicon Instruments Corporation, Chauncey, N. Y.

Ethane Useful in Tritium Measurements

A NEW method of measuring the ioactivity of tritium, a hydrogen ope, with ethane, a gaseous hydro- on, is being used at the Univer- of California's tritium laboratory La Jolla.

Three researchers in the Univer- 's chemistry department pointed that much larger amounts of hy- gen, the only gas used to date for nting gas-phase tritium, can be into a counter when the hydrogen irst converted to a hydrocarbon. The need for enrichment with tritium is lessened and the resulting measurements are more accurate, they said.

Drs. A. E. Bainbridge, Paula Sandoval and H. E. Suess report in Science that ethane, synthesized by mixing hydrogen with acetylene over a colloidal palladium catalyst, has "ideal" counting characteristics for low-level tritium activity.

The amount of radioactive tritium is used to date the age of recent air and water samples.

Book Condensations

ELECTRONIC PACKAGING WITH RESINS: A Practical Guide for Materials and Manufacturing Techniques — Charles A. Harper — *McGraw,* 339 p., illus., $11. Introduction to the developments in materials, methods and techniques employed in packaging electronic components.

ADVANCES IN PROTEIN CHEMISTRY, Vol. 15 — C. B. Anfinsen, Jr. and others, Eds.—*Academic,* 447 p., illus., $13. Reports on protamines, osmotic pressure, protein malnutrition in man and other research.

ASPHALT: Its Composition, Properties and Uses — Ralph N. Traxler — *Reinhold,* 294 p., illus., $10. Presents the chemical, physical, colloidal, rheological and durability properties of asphalt, its manufacturing and uses.

INTRODUCTION TO CHEMICAL ENGINEERING — L. Bryce Anderson and Leonard A. Wenzel — *McGraw,* 364 p., illus., $9.50. Surveys the professors of chemical engineering and the processes of the chemical industry.

ISOPROPYL ALCOHOL — Lewis F. Hatch — *McGraw,* 184 p., illus., $7. Comprehensive treatment of properties and applications of isopropyl alcohol.

ABSORPTION SPECTRA IN ULTRAVIOLET AND VISIBLE REGION (A Theoretical Introduction) — L. Lang, Ed. — *Academic Press,* 494 p., illus., ring-binding, $18. Results and data of recent experimental research work done at chemical and physical research institutes in Hungary.

THE CHEMICAL AND BIOLOGICAL A[C]TION OF RADIATIONS, Vol. V — [M] Haissinsky, Ed. — *Academic Pre[ss]* 278 p., graphs, $8. On mechanism the radiolysis of water by gamma ra[ys] action of alpha rays, diffusion kineti[cs] in radiation chemistry and mass spe[c]trometry.

AMERICA'S FIRST WOMAN CHEMIS[T] Ellen Richards — Esther M. Douty *Messner,* 191 p., $2.95. Juvenile bio[g]raphy about the first woman to stu[dy] at MIT, fellow of the AAAS and fi[rst] president of the American Home Ec[o]nomics Association.

CHEMISTRY AND TEXTILES FOR TH[E] LAUNDRY INDUSTRY — Harry Coh[n] and George E. Linton — *Textile E[d.] (Interscience),* 429 p., illus., $15. Fu[n]damental facts and technical data, textbook and reference work.

PHOTOCHEMISTRY OF AIR POLLUTI[ON] — Philip A. Leighton — *Academ[ic] Press,* 300 p., $11. Formulates bac[k]ground for the study of photochem[i]cal processes which may convert r[e]atively innocuous pollutants into su[b]stances which are nuisances and ha[z]ards.

DYEING OF CELLULOSIC FIBRES A[ND] RELATED PROCESSES — S. R. Cock[s] and K. A. Hilton — *Academic Pre[ss]* 417 p., illus., $12. Discusses prepa[ra]tion of fibres, colorants, preparati[on] and application of colorants, dyei[ng] machines and finishing processes.

INVITATION TO CHEMICAL RESEAR[CH] — E. Emmet Reid — *Franklin P[ub.] Co.,* 366 p., $10.60. Research chemi[stry] reminiscenses and professional kno[w]how for chemistry students.

Chemistry Comments

Interesting facts in the chemical world.

Cesium-137, a beta and gamma ray
nitter, has possible application in the
reservation of food and sterilization
medical supplies.

The spray 2,4-D injures the cabbage
ot causing slow growth or death to
ie plant.

Ice cream smoothness is controlled
a large extent by ice crystal size.

Nuclear batteries, radioisotope pow-
sources, may soon be used as a
bstitute or recharger for ordinary
orage batteries in remote locations.

It has been reported that large doses
steroids have successfully checked
e deadly kidney damage caused by
stemic lupus erythematosus, one of
e most serious rheumatic diseases.

Radiocontaminants reach food in
o principal ways, adsorption from
r onto surfaces of plant materials
d entry into soil and uptake through
e roots of plants.

Pyroceram, a material originally
vised for nose cones, is now used
r pots and pans which can be taken
t of a freezer and immediately put
the hottest flame without damage.

Strontium-90, cesium-137 and iodine-
1 cause the greatest radioactive con-
mination of food as a result of
clear tests.

Chronic bleeding from the stomach
d intestines may be corrected in
me cases by treatment with iron,
minating the necessity of surgery.

➤ According to tracer studies, at least some of the fats in atherosclerotic plaques are apparently made by the artery wall at the site where they appear.

➤ Tungsten, which has the highest melting point and the greatest strength of all the metals, is a promising material for application in rocket motors.

➤ The mitochondrion, a tiny cell particle, has been successfully taken apart and put back together again by scientists.

➤ All soil, rocks, and sand are slightly radioactive, but rarely if ever do they radiate enough to be harmful to plants, animals, or humans.

➤ Every year from Oak Ridge National Laboratory alone 14,000 shipments of nearly 100 different isotopes are made.

➤ The gas ionization chamber together with a sensitive and stable electrometer constitutes one of the simplest and yet most accurate methods of detecting radiation.

➤ The substitution of polyurethane foam in place of conventional sandwich construction components results in a cheaper, lighter and stronger fin for rockets.

➤ Urethane foam is sprayed inside cabs of electric utility company trucks in Canada for insulation keeping them warm in the winter and cool in the summer.